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Journal of the Society of Arts.

FRIDAY, MARCH 21, 1862.

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INTERNATIONAL EXHIBITION OF 1862.—SEASON TICKETS.

Members of the Society and others are informed that Season Tickets may be obtained at the Society's house, on application to Mr. S. T. Davenport, the financial officer. Price three guineas and five guineas, the latter also admitting to the Horticultural Gardens and *fetes* during the season.

INTERNATIONAL EXHIBITION OF 1862.—GUARANTEE.

The Council beg to announce that the Guarantee Deed is now lying at the Society's House for signature, and they will be much obliged if those gentlemen who have given in their names as Guarantors, as well as others interested in the Exhibition, will make it convenient to call there and attach their signatures to the Document. Signatures for sums amounting in the aggregate to £446,800, have been attached to the Deed.

WEEKLY PROGRESS OF THE INTERNATIONAL EXHIBITION.

The success of the Exhibition and the punctuality of the opening seem to be threatened by the delay of British exhibitors. The preparations of Foreign countries, contrary to the experience of 1851, seem to be in a much more forward condition than even those of our countrymen, who will require most time and trouble to complete their arrangements. Already several of the counters and fittings are erected in the French court, and the preparations of Austria, the Zollverein, and Belgium, are equally advanced; while on our own side scarcely anything is to be seen besides some very handsome cases which are being erected by Mr. J. Drew, for the leading goldsmiths' firms. An instance may be given of the supineness which seems to be the only thing at present exhibited by British manufacturers. A leading firm had obtained a large space for the erection of a trophy in the south-eastern transept, and accordingly some time ago they commenced digging the foundations on which to rest their bulky goods. The earth, so excavated, was thrown on the surrounding floor in such quantity as to sink the flooring several inches by its weight, and in this unsightly condition the whole thing has been left without being touched for nearly a fortnight, to the loss of the exhibitor, who has to re-lay the floor, and to the detriment of the Exhibition. English exhibitors will do well to consider that her Majesty's Commissioners are in earnest when they fix the 31st of March as the latest day on which cases, fittings, counters, and heavy goods will be received, and that they really are liable to be rejected if sent after that day. Of course light delicate objects, as philosophical and surgical instruments, which are liable to injury in a building where dust and dirt are prominent features, need not be in their places so early, but it is imperative that the cases which are to contain them should be on the spot, at the very latest, by that date. Carriages, too, which are easily brought into the building, will probably be admitted during the early part of April.

Mr. Crace's decoration of the domes, as seen from below, though concealed by the masses of scaffolding, promises to be highly effective, and when fully realised, as it may be by ascending a few ladders, amply repays the labour and fulfils its promise. The designs for the medallions in the spandrils have been executed by Mr. R. Burchett and his pupils, at the School of Art, South Kensington, in the short period of a fortnight. The flooring of the domes has also commenced in parts where it is not liable to be disarranged by the descent of the heavy balks of timber from above. As it is probable that the eastern dome will be the scene of the opening ceremony, it is important that it should be advanced as rapidly as possible.

The arrangements for the ceremony itself are not fully settled in detail, although to a great extent principles are determined on. One of such principles fully fixed is, that guarantors who may be season-ticket holders, will have priority in the selection of reserved seats for witnessing the ceremony.

The eastern annexe is getting gradually occupied with heavy cases, containing machinery, principally from abroad, though none of this is as yet fitted. It is expected that this week a rather novel sight will be witnessed in the streets of London; a large quantity of French goods, too heavy for the ordinary means of conveyance, will be brought from the river side to the Exhibition building by a train of waggons drawn by one of Bray's traction engines. Three heavy masses of steel, one of twenty, one of ten, and one of seven tons, are also expected to arrive from the Zollverein.

Preparations for erecting the trophies in the nave and transept are going on, though scarcely with such rapidity as could be desired. Messrs. Kelk and Lucas, who have taken, in many cases, the contracts for laying foundations, &c., have a great quantity of work on their hands. Messrs. Elkington have commenced the erection of their trophy of electro-plate, and the Coalbrookdale Company are well advanced with their arrange-

ments. On the Foreign side the French are beginning to raise a magnificent case of iron-work, by Barbezat, of Paris, the same gentleman who is erecting his fountain in the Horticultural Gardens. This beautiful piece of workmanship will be 120 feet long, and is to contain in the centre a glass 18 feet by 9. Norway, too, has commenced the erection of a stand of arms.

FOURTEENTH ORDINARY MEETING.

Wednesday, March 19th, 1862.

The Fourteenth Ordinary Meeting of the One Hundred and Eighth Session was held on Wednesday, the 19th inst., Mr. Alderman Mechi in the chair.

The following candidates were proposed for election as members of the Society:—

Coles, Charles	86, Great Tower-st., E.C., and The Firs, Mitcham, S.
Dawson, Henry	16, Finsbury-pl. South, E.C.
Dovey, Wm. Thos.	10, Cunningham-place, St. John's-wood, N.W., and 6, Crosby-square, E.C.
Houghton, James	114 and 115, Tottenham-court-road, W.
Howe, Wm. Francis	6, Newman's-court, Cornhill, E.C., & 5, Lower Belgrave-street, Eaton-square, S.W.
Mackay, Thos. Miller	24, Leinster-gardens, Hyde-park, W.
Marshall, Joseph Gilbert Blair	7, Vicarage-terrace, Stratford, E.
Pearce, Wm. Peter	66, Gresham House, Old Broad-street, E.C.
Preedy, J. K.	98, Gracechurch-street, E.C.
Purdy, William	54, Old Broad-street, E.C.
Ward, Wm. George	Sherwood-rise, near Nottingham.
Wood, Henry, Thos.	22, Watling-street, E.C.

The following candidates were balloted for and duly elected members of the Society:—

Alexander, Francis	103, Leadenhall-street, E.C.
Brown, Alfred	25, Newman-street, Oxford-street, W.
Capper, Walter	69, Gracechurch-street, E.C., and 3, Kidbrooke-terrace, Blackheath, S.E.
Chambers, Thomas, jun.	55, Coleman-street, E.C.
Clarke, G. Somers	20, Cockspur-street, S.W.
Davis, Geo. Henry, LL.D.	Religious Tract Society, 56, Paternoster-row, E.C.
Donne, William, jun.	51, Cheapside, E.C.
Edwardes, Alfred	Warwick-house, Regent-street, W.
Gooch, Thomas	Seacombe-lodge, Clapham-park, S.
Hollow, James	1, Crown-court, Old Broad-street, E.C.
Jordan, Henry	17, Gracechurch-street, E.C.
Lawes, Thomas	65, City-road, E.C.
Lines, John Phillips	Lloyd's Patriotic Fund, County Chambers, 14, Cornhill, E.C.
Macrea, Alex. Septimus	18, Chapel-street, Liverpool.
McCrae, Henry Chas.	Halifax, Yorkshire.
McEwen, David Painter	Highwood-house, Mill-hill, N.W.
Morse, Hon. F. H.	Consulate of the United States of America, 67, Gracechurch-street, E.C.
Mottram, John	Boy-court, 35A, Ludgate-hill, E.C.
Moulton, Stephen	Kingston-house, Bradford-on-Avon, Wilts.
Patten, William	22, Old Fish-street, E.C.
Porter, Robert	29, Great St. Helen's, E.C.
Prince, George	204, Upper Thames-st., E.C., and 32, Clifton-road, Carlton-hill, N.W.
Robinson, John	Durban, Natal; and 10, Arundel-st., Strand, W.C.
Skipper, Chas., jun.	1, St. Dunstan's-hill, Great Tower-street, E.C.
Spargo, Thomas	224 and 225, Gresham-house, Old Broad-street, E.C.
Walton, Christopher	24, Ludgate-street, E.C., and Highgate, N.
Watney, Norman	The Brewery, Pimlico, S.W.
Weston, Edward	Rokesby-house, Hornsey, N.
Whitaker, Joseph	Seaforth, near Liverpool.
Whitaker, William	Bradford, Yorkshire.
Wright, Philip	20, Adelaide-rd. North, N.W.

The Paper read was—

ON THE SEWERING OF TOWNS AND DRAINING OF HOUSES.

By Robert Rawlinson, C.E., F.G.S., &c., &c., &c.

Member of the Sanitary Commission sent out by her Majesty's Government to the Army in the Crimea.

Town-sewerage on a grand scale is certainly co-existent with the Roman Empire, and earthenware pipes are, probably, as old as the art of pottery. It has been ascertained that pipes of earthenware, "hand-thrown" on a potters' wheel, and not unlike, in form and dimensions, to hand-made pipes of the present day, were used throughout the East in the remotest periods we are acquainted with, to conduct springs of water for human uses.

Earthenware pipes have been found beneath the great mounds of Assyrian ruins, which pipes are supposed to have been drains; and the stalls in the Colosseum of Rome were drained with earthenware pipes. Earthenware pipes were also used by the Romans for watercourses.

The cloacæ of Rome, including the Cloaca Maxima, according to Livy, are as old as the reign of Tarquinius Superbus. Some authors declare that the construction of these public sewers must belong to an Etruscan Nation, which preceded the birth of Romulus and Remus.

These old sewers, the ruins of which are to be seen in Rome to this day, were also, "sub-ways" and sewers, having raised paths along the sides, and "side-entrances" for tributaries, from palaces and fountains. There were large cloacæ in the several cities throughout the empire, as mentioned Pliny's letters to the Emperor Trajan. I have met, in the works of travellers, with descriptions of other ancient sewers and drains found beneath ruins in the East, the date of the formation of such sewers being lost in the darkness of antiquity. It is, no doubt, impossible to trace out the origin of sewers and drains; their "invention," construction, and use, probably took place and commenced with civilization. We cannot, however, settle this point this evening. We have another purpose, namely, to discuss the uses and the abuses of sewers and drains at this day.

The Roman cloacæ were, probably, in many instances, of the character of the great sewers in this metropolis,—the Fleet, the Ranelagh, and others;—watercourses enclosed and arched to serve as sewers. The remains of sewers and drains found amidst ruins show us that their application was limited, and their uses only imperfectly understood. If sewers and drains had been generally in use amidst the populous cities and towns of antiquity we should now find their remains abundantly. We know the extent of the Roman Empire more fully and better by the buried remains of Roman pottery than by history, or than by any ruins or traces of ruins remaining on the surface. Brick sewers and earthenware pipe drains, if they had ever existed, would have been as enduring in their materials as frail pottery, or as the stone and brick cloacæ of ancient Rome and the drains of the Colosseum. We do not find such remains in abundance, and therefore conclude that a limited construction only took place for special purposes. The Roman cloacæ were originally under the superintendence of the censors; subsequently under that of the ædiles. The] Emperors Agrippa and Trajan constructed many cloacæ during their reigns. We, in these modern times, divest our Imperial Government of all such useful power.

Earthenware pipes, of three and four inches diameter, were made in England more than a half-a-century since, in Lambeth and in other places. Mr. Doulton, senr., can recollect their being made during this space of time, and I have received other evidence as to the make of earthenware pipes 40 or 50 years ago in England. The first modern use of them, for sewer purposes, was suggested by Mr. Edwin Chadwick, C.B., soon after the year 1840. Mr. John Roe states in his Report to the Harrow Local Board of Health (1854):—"The introduction of stoneware pipes for general drainage arose from a suggestion made by Mr. Chadwick to me, in his desire to obtain smooth interior surface; and the first sewer pipes made for that purpose in the metropolis were for the Holborn and Finsbury office." In consequence, Mr. Roe further states, "immense benefit to sanitary measures has been afforded by the use of earthenware pipes, where judiciously applied and properly laid. They save fully two-thirds the cost of brick sewers; that is, where brick sewers for a town would cost £30,000, the same town may be sewered by earthenware pipes for a cost of £10,000, and the cheaper pipes will effect the work far safer to health and life than the costly brick constructions." Combined back drainage is of the utmost importance, in point of economy, and also in efficiency of working, where the drain-pipes are properly laid. There are many thousands of instances of successfully combined back drainage, in scores of towns, and complaints of failure or of annoyance are very rare. I do not think they amount to one per cent. upon the work executed. Mr. John Roe, in 1854, stated that, "36 years previously (1818), 200 houses on one estate, in the Holborn and Finsbury districts, had combined back drainage, and no complaint of their working or otherwise ever came in that period of time to the office." Mr. Roe further states, "in many country towns and places, back drainage may be usefully adopted." This is the doctrine of the first Board of Health anticipated and confirmed. In some places back drainage will be impracticable, and, of course, should not then be adopted.

It is a great advantage to have a regular flow of water through any sewer. Drains are choked more from want of water, than by having too much passed through them. Combine drains as much as practicable, lay them well, joint them evenly, properly, and smoothly, and there will be very few if any chokings.

Fully to understand the worst effects of want of sanitary arrangements in towns, we must go back to the days of the plague, sweating-sickness, and other similar diseases, and read up the literature of 1600 and 1700, by Nathan Hodges, M.D., on the Plague of London, 1665; a Discourse on the Plague by Dr. Mead; an Essay on the Different Causes of Pestilent Diseases, by John Quincy, M.D., and others; until we come to James Lind, M.D., and Sir John Pringle, the one on diseases in the navy, and the other on diseases in the army. We may then visit the cities and towns in the East, where plague rages to this day, and see the causes in existence which prevailed in England two centuries since, and some of which causes prevail even now. Filth, squalor, darkness, neglect, vice, crime, and premature death; an annual mortality of 40, 50, and 60 in the 1,000 regularly, with an increase up to 100, 200, and even, in some places, 500 or a moiety of the entire population in one year, of plague and general sickness; "the living too few to bury the dead." The annual mortality of England at present in towns ranges from 30 to as low as 15, and even 11, in each 1,000. It is thought 15 ought not to be exceeded even in our towns.

The Sanitary Commission of 1855 in the Crimea, showed what could be done for an army in the field, where the mortality fell below that of the same troops in barracks at home, the French army knowing no such abatement. When fever had been all but banished from the British army and hospitals, the French at the end of the war were said to be losing by sickness in hospitals at a rate of 5,000 per month. 15,000 men perished in hospital during the last three months of the war, as per French army medical returns.

There are no doubt many causes for disease in excess, but overcrowding, defective ventilation, and surrounding filth, seem to be the worst. Proper sewers and drains will improve a town, but will not do all that is required.

The causes of fever in Liverpool, previous to the year 1840, were overcrowded cellar dwellings. The causes in Glasgow and in Edinburgh are overcrowded upper rooms and attics. The narrow streets, crowded houses, and small rooms of many continental towns may be improved by sewerage, drainage, surface pavements, and regular cleansing. But many of the causes of disease in excess might remain.

"Sewer," according to Lord Coke, a place where water "issues;" or, vulgarly, "sues," whence the word "suera" or sewers. There are laws relating to sewers from Magna Charta to recent times. Callis, on the law of sewers, is the great authority. These laws, however, relate to sea defences, weirs, rivers, estuaries, and land-floods, rather than to town sewers.

Many persons use the words sewer and sewage improperly; they should be used as—

Sewer, a public sewer in street or road.

Sewage, that which flows through a sewer—the fluid.

Sewers or sewerage, the plural of sewer.

Drain, a tributary to a sewer from house, building, or court.

Drains or drainage, the plural of drain.

Sewers were first constructed in London under an Act (6 Henry VI., c. 5), 1428, amended by parliament in the reign of Henry VIII., and since this period to the present time there have been many amendments and alterations of laws for regulating sewers, into which I do not propose to inquire. The streets of London were begun to be paved in 1533. The first sewers in London would no doubt be in the several valleys on the line of existing watercourses, the Fleet Ditch, the Ranelagh Level, &c. These watercourses were arched over, and the drainage of the adjoining streets and houses passed into them.

Stowe states that, "Antiently, until the time of the Conqueror, and two hundred years later, this City of London was watered (besides the famous river of Thames on the south part), with the river of the Wells, as it was then called, on the west; with a water called Walbrook, running, through the midst of the City, into the river of Thames, sewering the heart thereof; and with a fourth water, or bourn, which ran within the city through Langbourn Ward, watering that part in the east. In the west suburbs was also another great water, called Oldborn, which had its fall into the river of Wells."

The Fleet Ditch* was no doubt originally (in ordinary weather) a stream of bright, sparkling, sweet, and wholesome spring water—a river of "wells." But as early as 1290 the monks of White Friars complained to the king that the putrid exhalations arising from the river of Wells or Fleet, were so powerful as to overcome all the frankincense burned at their altars during divine service, and even occasioning the deaths of many of the brethren. The Fleet continued to receive additional impurities, until it became in the time of Pope—

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* "Fleet." This name is derived from the rapid flow of water from the higher districts drained.

> "The king of dykes, than whom no sluice of mud
> With deeper sable blots the silver flood."

Barges are said to have sailed up the Cloaca Maxima and the Fleet sewer alike; in both instances natural water-courses having been arched over and made receptacles of sewage.

Although the first formation of public sewers in the British metropolis dates so far back as 1428, by far the greater portion of the 1,500 miles of the main sewers in London have been constructed since the year 1824, Mr. John Roe having had the perseverance, honour, and credit of effecting more improvements in the main sewers of his districts, Holborn and Finsbury, up to the end of his period of service, than any other man. The improvement of adopting the egg-shape, in place of vertical sides for sewers, the introduction of side entrances, and means of flushing, and the experiments carried out by Mr. Roe and tables based on these experiments, are invaluable for the metropolis. Mr. Roe found the construction of sewers a matter of guess; he left it a matter of scientific certainty. If all the sewers of this great metropolis had been laid out and constructed on the plan proposed and adopted by Mr. Roe, in his divisions, vast additional sums of money would have been saved, and (humanly speaking) many lives prolonged; the flat-bottomed sewers which now exist would have had semi-circular channels, and the deposit which now accumulates and corrupts would have been regularly washed out, or periodically "flushed" out at short intervals. Mr. Haywood has more recently done for the City what Mr. Roe did for Holborn and Finsbury.

The ventilation of sewers by vertical shafts and open grates in the centres of the streets was, no doubt, an improvement, though a very clumsy and disagreeable plan. Previous to the formation of these open ventilators, typhus and typhoid fevers prevailed in many houses connected by drains with the sewers and near the untrapped gully-holes. Mr. Fuller, a medical gentleman, in his evidence, 1834, states that eight-tenths of all the cases of typhus fever he witnessed he could trace to foul drains or foul gullies. The late Dr. Southwood Smith gave evidence to the same effect.

At present there is much injury effected by sewer gases passing through drains and into houses. In 1859, on the use of a disinfectant in the public sewers having a powerful odour, all the houses directly drained by these sewers were tainted, shewing that there was a flow of air from the sewers to the houses. This should not be, and can only be avoided by external ventilation of each house-drain.

The progress of a nation may be measured by increase of population, by spread of education, by increase of commerce and wealth, by increased value of human life and respect for it, and by improvements in morals, in obedience to the laws of the realm, and in religion. We may read, in the eloquent pages of our great historian, Lord Macaulay, how England appeared about the year 1688. He wrote:—"Everything has been changed but the great features of nature and a few massive and durable works of human art. We might find out Snowdon and Windermere, the Cheddar Cliffs and Beachy Head—we might find out here and there a Norman minster, or a castle which witnessed the wars of the Roses; but, with such rare exceptions, everything would be strange to us. Many thousands of square miles which are now rich corn land and meadow, intersected by green hedge-rows, and dotted with villages and pleasant country seats, would appear as moors overgrown with furze, or fens abandoned to wild ducks; we should see straggling huts built of wood and covered with thatch, where we now see manufacturing towns and seaports renowned to the furthest ends of the world."

The population of England, in 1690, was computed at nearly five millions and a half. The manners of the inhabitants were in accordance with the state of the country. In the northern counties bands of Scottish marauders fought with moss-troopers—the parishes were required to keep bloodhounds for the purpose of hunting freebooters—oxen were penned at night beneath the overhanging battlements of the residences—the inmates slept with arms by their sides—and, on a journey, it was necessary to carry provisions, for the country was a wilderness which afforded no supplies. Such was the state of England at the commencement of the year 1700, or little more than a century and a half since. To find a parallel to this state of things, we must now go to Russia in the north, and to the cities of the Sultan in the east. Here we may see vast tracts of land uncultivated, and without proper roads—the inhabitants wearing, and even working with, weapons of defence and offence in their belts or sashes—cities and towns reeking in filth—hovels for houses—food of the worst and poorest character—no security for person or property, human life having the least possible value—poor cultivation of land—no proper roads—in the towns no sewers no drains, but a maximium of human misery and degrading vice in the East, and of drunkenness and ignorance in the North.

To ascertain the state of England in our own day, and at the present time, we must study in "Blue Books" the sanitary reports; and, although a commencement of sanitary work has been made, there are vast and wealthy populations living amidst cesspits and cesspools. The good work has, however, been commenced—about 400 cities, towns, and places in England having adopted the powers of the "Public Health Act," 1848; or of the "Local Govvernment Act," 1858. The "Common Lodging Houses Act" of Lord Shaftesbury may be adopted; and, where put in force, the results are most beneficial.

The question of sewerage and drainage concerns the poor more than the wealthy. Firstly, on account of numbers; and secondly, because of close crowding. The poor must live, or linger rather, in squalor, sickness, and misery, and die prematurely, in such habitations as are provided for them. The fatal room tenements in English towns, the mud cabins of Ireland, and the boothies of Scotland, all tend to fill our gaols, lunatic asylums, and workhouses. When shall we learn and fully comprehend the fact that it will be more in accordance with the requirements of civilisation, and even more economical, to prevent vice, and to make virtue possible, rather than to expend all our energies on reformatories, to make home comfortable rather than to build and endow public libraries, lecture-rooms, and reading-rooms? Do not neglect these, but first make the poor man's home wholesome.

The preponderance of numbers is shown in the case of Manchester and Salford. From a return by the Poor-Law Board of the numbers and occupiers of dwellings in parliamentary boroughs, it is shown that in Manchester, in 1859, there were 64,426 separate dwellings, of which number 24,457, or 38 per cent., were of £10 annual rental or upwards; 22,538, or 35 per cent., below £10 and above £6 rental; and 17,431, or 27 per cent, not exceeding £6; or, in the whole, about 62 per cent. at and below £10 rental.

In Salford there were 20,156 dwellings; 5,205, or 26 per cent., of £10 rental and above; 8,131, or 40 per cent., of £6, and below £10 rental; 6,820, or 34 per cent., not exceeding £6 rental. Taking Manchester and Salford in one district, there were 84,582 dwellings, of which 29,662, or 35 per cent., were £10 rental and upwards; 30,669, or 36 per cent., of £6, and not exceeding £10 rental; and 24,251, or 29 per cent., at and under £6 annual rental.

Many of the houses below £8 per annum rental are of faulty construction. They are generally in rows, back to back, having no back doors nor windows, no yard nor privy, no sinkstone, nor internal water supply. Many sleeping-rooms have no flue, nor adequate means of ventilation. Privies have to be used in common, and, of course, are not what the name implies; they are frequently ruinous, and sickeningly dirty. Experience has shown that numbers of families should not be compelled to use privies common to several houses, unless regular cleansing is enforced. Every dwelling-house should have its own convenience. It is a libel on the poor to say they will not care for their own comfort. There are thousands of instances to the contrary. In Manchester, for the poor, waterclosets are the exception. The local municipal regulations discountenance them.

The annual death-rate in Manchester is 30·56 per thousand, or double the death-rate in some districts. The death-rate throughout the manufacturing towns of Lancashire and Yorkshire generally is high, and will continue to be so until better sanitary regulations are adopted and enforced. The excuse offered by the Manchester Corporation is, " Supplying the poor with waterclosets, would waste water, and foul the rivers." Proper apparatus will prevent the first, and intercepting sewers the latter.

London shows a diminished death-rate in proportion to the abolition of cesspools, although the sewerage is most defective, and the River Thames is fouled. Many thousands of cesspools have been abolished in the metropolis, probably not less than 100,000, within the last twenty years, but many thousands remain. Mr. John Roe, and some of the other district engineers, improved many miles in length of the metropolitan sewers and drains, but there are still many miles in length ruinous and foul. London is, however, much more healthy than the manufacturing towns of Lancashire and Yorkshire.

Those who wish to experience the horrible character of the cess-pits and middensteads of Manchester, Liverpool, and other northern towns should study the statistics as they are weekly recorded, of 1,200 and 1,400 such places emptied, and then make a few night inspections of the localities in the hands of the "night-men ;" the stench is abominable, many times worse than the Thames at its worst. The rivers flowing through Manchester can scarcely be worse than at present. The Irwell, the Medlock, and the Irk, are a disgrace to our civilization. They are fouled from their sources to their estuary ; and if the erection of water-closets could be absolutely prohibited, the construction of intercepting sewers should be made imperative. The solids of sewage can be precipitated, but agricultural land is the proper place and use for sewage.

In many cities and towns where sewerage and drainage are carried out, water closets are in general use. This is the case in the metropolis. For several years past some 1,000 soil-pans have been made and sold per week, or some 50,000 per annum, and they are, of course, used. In the cities and towns of Berwick-upon-Tweed, Alnwick, Morpeth, Carlisle, Lancaster, Halifax, Worthing, and many other places in England, the poor use this convenience, and do not abuse it. In Manchester 100,000 loads of night-soil are annually removed at a loss of some £6,000 per annum. In London the removal of dry ashes produces an income to the parishes.

There is no general rule for the dimensions of town sewers for populations below 100,000 in proportion to surface area; and any engineer who adopts the dimensions given in certain published tables will most probably make an expensive mistake for the district in which he is operating. The tables which are based on experiments made in the Metropolitan sewers are no doubt correct and absolute for the districts from which they were constructed, and will be applicable to any other similar district, if all the peculiarities and contingencies are similar, but they are not applicable to towns generally. I have never used these rules, and should have caused great waste of money if I had done so. The science of engineering cannot be tabulated, and this truth ought to be inculcated on every student. As well say that all sorts of diseases can be cured with one set or sort of pills, as that tables of strengths of materials and dimensions of sewers can be relied upon, without the experience of practice. The published tables I allude to have worked injury, not only in Great Britain, but all over the continent, where many sewerage works have been attempted. The civilized world looks to this country for practical information on this subject.

The recorded experiments of the best hydraulic engineers on the flow of water in open channels and in pipes may be relied upon. There is little to learn in this branch of hydraulics. Pipes have capacity in proportion to the squares of their diameters, and water obtains downward velocity in strict accordance with the laws of gravity, modified by friction in its thousands of forms. The invert gradient of a sewer is one element in the law of flow. The head of water and delivery are other elements, giving velocity and scouring power. I only object to tables of sectional dimensions for general use. The town of Alnwick, in Northumberland, with its 2,000 acres of drainage area, its 7,000 population, and some 1,000 waterclosets, is sewered by an earthenware pipe 18 inches diameter, and having a gradient of 1 in 400. Carlisle, with its 1,900 acres of drainage area, and 35,000 population, has an outlet sewer of 3 ft. 9 in. by 2ft. 6 in., with a fall of 1 in 700.

At Worksop the outlet sewer is an earthenware pipe, 15 inches diameter, laid at an inclination of 1 in 600. The population is upwards of 7,000, and the drainage area very large.

At Lancaster the outlet sewer is of brick, 5ft. 3in., by 3ft. 6in., and laid at an inclination of 1 in 1,000. The population is about 15,000, and the drainage area considerable, having a rapid fall in some parts.

At West Ham, with an area of 4,730 acres principally of flat water-logged marsh land, the outlet sewer is of brick, 5 ft. 3 in. by 3 ft. 6 in., having a cast-iron invert laid level, and and at low-water line of spring tides.

In all these cases the dimensions of the outlet sewers do not accord with the tables alluded to, and yet the sewers perform the work required to be done. Surface water and heavy falls of rain pass, as previously, over the surface, but there is not a duplicate system, nor do I advocate such.

At Carlisle the outlet is frequently blocked by land-floods ; at Lancaster, daily, by tides ; and at West Ham pumping is resorted to.

The first questions an engineer should ask himself with respect to any district or area to be sewered should be these:—" How have surface waters passed off up to this time without the aid of sewers or drains ?" " Have any surface impediments been formed ; if so, what are the effects, and can such impediments be removed ?" " Have houses been erected and cellars excavated in improper places, and where injurious flooding cannot be prevented excepting at a ruinous cost to the rated property of the district generally ?" " Can watercourses in the valley lines be deepened at a moderate cost ?" and, " Can embanking and pumping be resorted to economically ?" " Are there any mills and mill-dams which impede drainage and cause injurious subsoil—flooding regularly, and injurious flooding at intervals ?" All these questions have a most important bearing on the dimensions of sewers.

It may look very egotistical, but I can better give an account of my own practice than that of any other person, and detail my own experience more confidently than stereotype it in tables, which must, in such form, be misleading and injurious.

Natural streams down valley lines should never be converted into sewers. The maximum flow of water in such streams is to the minimum as three hundred or four hundred to one. Any sewer formed in such valley line of sufficient capacity to carry off flood waters, would be much larger than requisite for the ordinary flow, and would become a cause of nuisance in dry weather. All valley lines should be improved, and the beds of natural streams should be preserved free and open for the escape of surface and flood waters. Sewers and drains should be of sufficient capacity to remove roof, yard, street soil, subsoil, and slop-water from the area drained during ordinary weather, and should be graduated to the amount of work to be done. Flood-water outlets or overflows into valley lines, or natural streams, to relieve the sewers during heavy rains, should be provided. There may be large gratings to remove surface storm waters at the outlet points of valley lines, but care must be taken not to make such places large stagnant cesspits.

All sewers and drains should be properly ventilated. This may be effected by connecting down-spouts with house-drains in proper situations; by connecting sewers with tall chimneys; or by providing, on the sewers and drains, ventilating shafts with charcoal filters for oxidising sewer-gases. All sewers should have means of inspection, flushing, and cleansing provided. Sewers should be laid in straight lines, and with regular gradients. At each alternate change in direction, or alteration of gradient, a manhole or entrance to the sewer should be constructed. Agricultural drain tiles are laid in straight lines. Ploughing, on the most approved plan, is also in straight lines. In both cases, truth and efficiency of workmanship are attained, and straight sewers and drains insure good workmanship. One defective link breaks the chain; one defective pipe-joint or defective yard of sewer is injurious.

Brick sewers should be formed of radiated bricks, set in hydraulic mortar. Pipes should be jointed with clay-puddle, or with cement, or mortar, or asphalte, according to the nature of the ground in which the pipes are laid. Great care should be taken in laying pipes in rock, in gravel, and also in clay. Many lines of sewer pipes are injured by injudicious filling of a trench, or by a fall of clay or earth crushing the pipes. The inlets of all drains should be properly protected, and the openings should be reduced so that any substance entering the drain may pass freely into the main sewer.

Where a sewer or drain has once choked, and the ground is opened out for repairs, do not close it in again, but construct a manhole or lamphole, that any future obstruction may be removed at once.

Sewers and drains act as subsoil-drains to the full depth at which they are laid. In wet subsoils provision should be made for allowing subsoil-water to enter the sewers. A continuous flow of subsoil-water along a sewer or drain is generally an advantage, as the solids of sewage are more readily removed.

Neither sewers nor drains should be laid under new inhabited dwellings. If it be absolutely necessary to carry a drain under a house, the drain should be carefully laid, and the joints made perfectly tight, so as to prevent the escape of sewer gases into the adjoining subsoil. Many lines of earthenware pipe sewers and drains are ruined when laid in porous subsoils with leaking joints. The fluid sewage leaks away, and leaves the solids to accumulate and ultimately to choke the sewer or drain, as the case may be. Puddle should be used in such cases.

All junctions with main sewers should be made at a point above the ordinary water-level in such sewers; and at the junction of branch or main sewers, the top of the sewers should be on the same level. Additional fall should be given at junctions or bends, to overcome increased friction. Junction entrances, provided for branch sewers and house drainage, should be protected by earthenware plates, or "disc-plugs." Street gullies should be small, compact, and double-trapped. There should be a sediment box, easily removed and easily replaced. Means of flushing should be provided in the gully, that choking of the pipe connection with the sewer may be impossible. Large cesspit gullies are a nuisance. Small gullies of cast-iron are generally found the cheapest and best; increase the number of small gullies, rather than construct large cesspit gullies.

Fresh sewage, when properly diluted, filtered, or disinfected, may be passed into rivers, or into the sea, without causing nuisance or injury to fish. In arranging outlet sewers, provision should be made for applying the sewage to land in the immediate neighbourhood, for agricultural uses, by gravitation if practicable. Pumping by steam or other power is available. A town standing on ground having quick gradients requires special arrangements to break the rush of water down and of gases up. This can be done by breaking the line with a vertical fall, placing a flap over the mouth of the sewer, and ventilating at this point. The outlet ends of all sewers should be protected with a covering flap, to prevent the wind blowing in and driving back sewage gases. A cast-iron pipe of comparatively small dimensions on any river outlet-sewer, will pass the dry weather flow of sewage to and below the summer level of the river, so as not to be a nuisance.

It is not the special province of an engineer to enter into the question of diseases and their causes. There are many causes of disease other than filth, the result of no sewerage, or of defective sewerage; and even fevers may break out in a sewered town. Deficient and bad food, defective house accommodation and overcrowding, intemperance, and excesses of any kind, mental excitement, improper and deficient clothing, all tend to disease. The foundation of social improvement and comfort is, however, proper sewerage. The scale may be arranged in the following order, as things necessary in towns for health and comfort to the highest degree :—

1st. Main-sewerage, house-drainage, and street-pavements.

2nd. Good house-accommodation; rooms for the sexes, separate, with full ventilation.

3rd. Wholesome food, pure water, and proper clothing.

Then may be added, baths, reading-rooms, and museums.

A city of palaces, museums, picture-galleries, and of cesspools, is a sorry affair—a place to avoid rather than to dwell in. The cesspools of Paris detract from the beauties of the city above ground; and who is to visit and dwell in the cities of the Continent generally, if they remain neglected? Climate is blamed for producing disease in excess and premature death, but my experience has taught me that in any country and climate we must look to the habits of the people, and within their houses, rather than to the climate, for causes of disease in excess.

The cost of town sewerage works is an important matter; and as continental governments look to England, and especially to the British metropolis, it is only right that they should have some sort of rule to judge by. In my experience I find that towns of and below 30,000 of population may have complete sewerage at or below one pound sterling per head. Where a population is compacted into a small area, and means of outlet are not distant, as in the cities on the Rhine, the estimate of one pound sterling may be relied on. But large brick sewers, for men to walk and work in, must not be constructed. The sewers must be of small sectional area, and so arranged that they may be cleansed absolutely and perfectly without sending men in and through them.

All rivers and streams are natural outlets for drainage, and since men have dwelt on the banks of rivers, surface refuse has been allowed to pass into and mingle with the waters. There is at present a great outcry against the pollution of rivers by sewers, and the killing of fish. The questions may be asked, "Whether is it better to pollute rivers, or towns and houses? to kill fish, or to kill men?" I do not advocate the pollution of rivers, but the application of sewage to land for agricultural uses. If it will not pay, in some cases, as a commercial speculation, make it compulsory, and pay the cost by rate. By far the most expensive process in any community is filth in cesspools beneath houses, or on the surface around human dwellings.

Proper sewers and drains deliver sewage at the outfall fresh, and in this state fish are not killed, but are fed. The putrid sewage flushed from the foul sewers of the metropolis during hot weather by a thunder storm, taints the river and poisons fish; but even in the hot summer of 1859 the mortality in London was low, although the Thames was foul. As cesspools have been abolished, the public health has improved, and if all the sewers were of sectional dimensions, forms, and gradients (as they may be) to transmit fresh sewage, and not retain it until putrifaction sets in, the public health would be further improved. It is practicable to so improve and manage the public sewers of this metropolis, that sewage one day old shall not remain, but shall be in motion towards some outlet; and in motion there is safety, but danger in stagnation.

The full and proper ventilation of sewers and drains is of the utmost importance; drains should be so laid and arranged as to render contamination of the air within houses (by sewage gases) impossible. At present, the sewers of the metropolis, with exceptions in the City, as recorded by Dr. Letheby and Mr. Haywood, ventilate, for the most part, direct to the open air, by means of the vertical shaft from the crown of the sewer. The gases of decomposition rise direct out, and road dirt, stones, and grit fall in. The gases foul the air in the street, and the dirt, ground by traffic through the open grates blocks the invert of the sewers. The proper way to ventilate is to form a side-chamber, or side-shaft, and to place charcoal in the passage of communication from the vertical shaft by the side-chamber, so that all the gas escaping may be oxidised. The side-chamber receives the dirt falling through the ventilating-grate; it cannot enter the sewers. House-drains may also be ventilated in a similar manner.

Dr. Stenhouse pointed out the true uses of charcoal in 1853. I commenced the use of charcoal for sewer ventilation about the year 1858; and Dr. Letheby and Mr. Haywood commenced their elaborate and valuable experiments also in 1858. I think I may claim to have been one of the first, if not absolutely the first, to apply the use of charcoal for disinfecting the sewage gases of an entire town, upon a general plan, as part of a sewerage system. I may instance Worksop, Buxton, and West Ham.

Cesspools may be ventilated through charcoal with advantage, where they cannot be abolished entirely, which is the only safe remedy. At the County Hospital, Winchester, a large cesspool, some eight feet diameter, is ventilated through a covering of charcoal. The arch covering of the cesspool was removed; a wire-work basket, about ten feet square, supported on iron framework, covers the entire area of the cesspool, and this is filled with charcoal, broken fine (like peas), to a depth of twelve inches. There is a roof over the charcoal to prevent its being wetted by rain, and the whole is walled in so as to leave a clear passage round. It is reported to answer fully—there is certainly no nuisance from cesspool gases at this point.

The following are details of sewerage works executed:—

CARLISLE.

The "drainage area" of the district sewered is about 2,000 statute acres.

The main outlet sewer for the entire area is 3 ft. 9 in. by 2 ft. 6 in. The sewer is laid with a gradient of 1 in 700. The outlet is extended to the centre of the river Eden, so as to deliver the sewage into the water of the river in the driest weather. The main-sewer, and the low-lying portions of the city, may be relieved by flood-outlets, of the drainage of 1,930 statute acres.

The "drainage areas" of the several "flood-outlets" may be described as under:—

	Areas in acres.
1. Swift's-lane	330
2. Bitt's-bank...	50
3. Castle mill...	170
4. Dow-beck and Milbourn	750
5. Paddon-beck and Newtown ...	630
Total area in statute acres.	1,930

The surface was most carefully considered, and all available means were used to prevent damage or inconvenience from local storms and flood-waters. The main sewers and secondary branches are built of bricks, moulded to the sectional form required for each sewer, and set in engine-ground hydraulic mortar.

Cast-iron pipes were used in crossing under rivers and watercourses and for the main low-water outlet. The means of flushing from surface waters are full and ample. Flushing-valves or sluices are provided on the Caldew, the Eden, Mill-beck, &c., and from a flushing-chamber in English-street (the highest part of the city), the sewers in 28 streets in every direction may be flushed.

The sewers are designed to remove all sewage refuse without pumping. This will be accomplished completely at all ordinary times. An extraordinary flood may block the outlet, and a long-continued rain may then, for a short time, fill the lower sewers, simply because the surface waters impede all action; at such time the largest sewers would be filled, and, for a time, their delivery would be impeded. There have been as heavy floods in the district since the completion of the works as any previously recorded, causing no injury to the sewers. There has been local flooding, but no one blames the sewers as the cause.

The following are details of expenditure:—

Brick Sewers.

Size of Sewer.	Length in yards.	Average Cost per yard.							
ft. in. ft. in.		s.	d.	£	s.	d.	£	s.	d.
3 9 by 2 6	2,285	29	1½	3,326	19	10			
3 4½ ,, 2 3	1,993⅓	24	8	2,455	6	8			
3 0 ,, 2 0	1,385⅔	21	6	1,491	16	2			
2 3 ,, 1 6	3,209	16	6	2,644	0	11			
Total Length of Brick Sewers..	8,873 yds.			Cost......			9,918	3	7

Earthenware Pipe Sewers.

ft. in.	Yards.	Cost.							
		s.	d.	£	s.	d.			
1 6	646	9	7	310	2	4			
1 3	4,352	8	5½	1,842	6	4			
1 0	6,509	6	8	2,167	11	9			
0 9	2,509	4	10	608	18	0			
0 6	168	3	10	32	4	0			
Total Length of Earthenware Pipe Sewers.	14,184 yds.			Cost......			4,961	2	5

Cast-iron Sewers.

ft. in.	Yards.	Cost.							
		s.	d.	£	s.	d.			
2 3	297	61	3½	910	3	2			
1 6	677	29	0	981	6	9			
1 0	48	18	2	43	10	9			
Total Length of Cast-iron Sewers	1,022 yds.			Cost			1,935	0	8
							£16,844	6	8

Summary of Sewers.

	Length in Yds.		£	s.	d.
Brick Sewers	8,873	Total Cost.........	9,918	3	7
Earthenware Pipe Sewers...	14,184	Total Cost.........	4,961	2	5
Cast-iron Sewers...............	1,022	Total Cost.........	1,935	0	8
Total length	24,079		16,814	6	8

Man-holes.

	No.	Average Cost.								
		£	s.	d.	£	s.	d.			
On Brick Sewers	67	21	4	7	1,422	7	7			
On Earthenware Sewers	60	7	1	1½	423	8	0			
On Cast-iron Sewers......	4	9	1	11	36	7	8			
Total Man-holes ...	131				Cost......			1,882	3	3

Lamp-holes.

	No.	Average Cost.							
		s.	d.	£	s.	d.			
On Brick Sewers	18	34	6½	31	1	9			
On Earthenware Sewers	79	37	11½	149	18	6			
On Cast-iron Sewers......	2	65	3	6	10	6			
Total Lamp-holes...	99			Cost......			187	10	9
Gullies	366	59	0				1,086	2	0
Flood Outlets							445	16	9½
Flushing Valves and Sluices							341	14	6
Crossing Rivers, and Sundry Expenses							747	3	7½
							21,504	17	7
Engineer in Chief							1,150	0	0
H. McKie, Resident Surveyor, and Inspectors of Brickwork, &c.							505	9	0
Incidental Charges, say..................................							150	0	0
							23,310	6	7

Rateable Value...£60,378 7 9
Number of Houses about 6,838
} Annual Rate in the Pound required to repay Principal and Interest in 30 Years, 6d.

	£	s.	d.
The cost of draining "self-contained" houses, including one water-closet, was ... about	£6	2	1
The same, without a water-closet, about	5	6	4
The cost of draining "tenement houses" with one water-closet for each house, taken on an average of 71 tenements, was, per tenement	1	6	7
The cost of draining "tenement houses" without water-closets, taken on an average of 66 tenements, was, per tenement ...	1	10	0

Where a water-closet has not been used, a cess-pit has been drained, and the drain is laid at a greater depth, involving larger cost. Where a water-closet has been used, the cess-pit has been filled up.

All cess-pits should be abolished, as nuisances, which draining only ameliorates, but does not cure.

WORKSOP.—General Description of Works.

The outlet-works consist of six trenches about 200 feet long, three feet deep, and eighteen inches wide at the bottom, with side slopes of one to one. These trenches are provided with sluice-arrangements at each end, to allow of the sewage being diverted as may be required, either for cleansing the trenches or for other purposes.

At the termination of the outlet-sewer provision has been made for passing limewater, or other disinfecting fluid, into the sewage, and moveable screens, for inter-

WORKSOP MAIN SEWERAGE WORKS.

Particulars of Cost.

DESCRIPTION OF WORKS.	Quantities.		Average Cost per yard.	Cost.	Amount.
	Cub. yds.	Cub. yds.	£ s. d.	£ s. d.	£ s. d.
Brick Sewers—					
2 ft. 0 in. diameter. 9 in. thick	64	..	0 19 9¼	63 5 3	
2 ft. 3 in. by 1 ft. 6 in. 4½ in. „	950	...	0 13 8	648 17 1	
Total Brick Sewers	...	1,014	...	...	712 2 4
Earthenware Pipe Sewers—					
15 inches diameter	3,695	...	0 5 3	970 0 4	
12 inches do.	4,084	...	0 4 6½	929 14 0	
9 inches do.	3,537	...	0 3 2	560 2 3	
Total Earthenware Pipe Sewers... ...	...	11,316	...	...	2,469 16 7
Cast-iron Pipe Sewers, for crossing canals and rivers, including cost of retaining walls, puddle, pitching, &c.					
15 inches diameter	69	...	2 13 5¼	184 7 8	
12 inches do.	18	...	3 5 2	58 13 0	
9 inches do.	12	...	1 13 0	19 16 0	
Total Cast-iron Pipes	...	99	...	...	262 16 8
Total Length of Sewers	...	12,429 or 7 miles 109 y.			
	Number.		Each.		
Manholes	75	...	6 15 6	508 2 9	
Lampholes	48	...	2 1 0½	98 9 9	
Gullies, with drains complete	136	...	2 1 11¼	285 3 8	
Three Flushing Chambers and three Overflows ...	6	...	4 13 8½	28 2 3	
Ventilating Shafts	51	..	1 16 6½	93 4 3	1,013 2 8
Outlet Works complete				...	257 1 4
Timber and Concrete in trenches				57 15 4	
Disc Plugs and fixing				7 17 0	
Making connections with old Sewers, &c.				18 3 11	
Assistance in levelling and sundry expenses				13 12 10	97 9 1
Land and Compensation				...	331 19 6
Rent of Pipe-yards and sundry expenses				...	3 16 4
Advertising and Stationery, &c....				...	28 13 9
Law expenses				...	20 19 9
R. Rawlinson, Engineer				394 3 0	
W. McLansborough, Resident Engineer—Salary, office rent, and expenses... ...				279 18 7	674 1 7
Total Cost					5,871 19 7

N.B. Earthenware pipes, 15 inches in diameter, were delivered at Worksop at 11d. per lineal foot; 2s. 9d. per yard.

cepting solid matter, have been placed in the trenches. Two outlets for filtered sewage-water are provided into the river Ryton. The area sewered is about 400 statute acres.

The sewer from Bridge-street to opposite Beaver-place is of brick, egg-shaped, 2 ft. 3 in. by 1 ft. 6 in. At the termination of the brick sewer an overflow into the river Ryton is provided, and from this point to the outlet works the sewer is formed of 15-inch earthenware pipes, cast-iron pipes of the same diameter being laid across the river and mill stream. The outlet sewer has a fall 1 in 600. This outlet serves for the entire district. The sewers are formed principally of stoneware pipes of 15, 12, and 9 inches diameter. The manholes and lampholes are furnished with moveable covers to admit of the sewers being examined. The ventilating-shafts are fitted with charcoal-filters, through which the sewer gases are passed and thereby oxidised. Seventy-five manholes, 48 lampholes, and 51 ventilating shafts are provided on the sewers.

Manholes throughout the entire system are provided with grooves for flushing sluices, and, in addition to these arrangements, flushing-tanks have been constructed at the upper ends of the sewers. Connections, for flushing purposes, have also been made with the open drain or water-course in Chesterfield-road, and with the canal near East-gate.

136 gullies (including five for storm waters) are fixed within the district. The gullies are double-trapped, and are so constructed as to prevent road dirt and solid substances passing into the sewers. Two overflows for storm waters have been provided near Beaver-place, and one for Low Town main.

Sewers are laid under the Chesterfield canal at two points, and over and under the river Ryton, and the canal feeder at seven points. In all cases the crossings have been made with cast-iron pipes of 15, 12, or 9 inches diameter.

The site on which Worksop is built presents several natural and artificial difficulties to cheap sewerage works. The valley is flat and liable to rain-floods; the river had to be crossed several times, as also the canal on one side, and the canal feeder on the other. The outlet works are simple in plan and economical in cost. Expensive tanks have been avoided, and the cheapest, but most effectual, means for intercepting and removing any solid, flocculent, or discolouring matter have been adopted. The experience of two summers has shown that these works are efficient.

The proper place for liquid sewage, however, is the land, and the best filter is vegetable soil under full cultivation; but when the sewage is so used at Worksop, the existing outlet works will be necessary, as it is advisable to intercept any floating solids and to irrigate with the fluid above.

The entire of the sewage of Worksop may be carried on and over the land below the outlet works very cheaply, by contour conduits, and be distributed by surface irrigation. A small outlay on such works, and intelligent management in irrigating and growing appropriate grasses, will prove beneficial to the farmer.

The entire system of sewers in Worksop is fully ventilated by special arrangements for this purpose at 51 places, and these include all upper ends of sewers. The estimated cost of the works was £6,000; the actual cost, including all contingencies, was £5,871.

BUXTON.

Description of Sewerage Works.

Outlets.

Two outlets for sewage have been formed into the river Wye; one near Wye-bridge, and the other opposite Duke's drive. The outlet sewers are so arranged with regard to levels as to allow of the whole of the sewage being applied, by gravitation, in irrigating the land in the valley of the Wye.

Sewers, &c.

The district for sewerage purposes has been divided into two "drainage areas," the main sewer for each sub-district being formed of 15-inch stoneware pipes.

In many portions of the town the sewer excavations were made, wholly or partially, in limestone rock. In such cases the trenches were excavated six inches below the proposed level of the sewer, and a properly prepared bed was formed for the pipes by filling in the trench with clay, gravel, or sifted earth. Manholes and lampholes have been provided at all the changes of direction or alteration in gradient of the sewers. Flushing chambers have been constructed at the upper ends of the sewers, and provision has also been made for flushing from the baths and from the river.

The sewers from "High Buxton" have gradients of about 1 in 10. Overflows into the river Wye, for relieving the sewers during heavy rains, have been formed at river crossings and other suitable points. Ample means have been provided for ventilating the sewers by about thirty shafts furnished with charcoal filters.

My estimate for the public sewerage works of the district was £3,203. The actual cost of the works as carried out was £3,107 6s. 10d.

Sewerage Works.—Particulars of Cost.

Earthenware Pipes.	Quantity.	Average Cost.			Amount.		
	Lineal yards.	£	s.	d.	£	s.	d.
15 inches diameter	1,590	0	8	3	657	11	9
12 inches do.	2,522	0	6	0	756	19	2
9 inches do.	2,151	0	4	6	483	10	8
Total Length of Sewers.	6,263						
	Number.						
Manholes	45	11	11	0	520	17	4
Lampholes	35	5	11	0	196	1	9
Gullies	20	3	2	0	62	0	0
Cast-iron Pipes for crossing river outlet works and sundry works in connection with sewers—Compensation, &c...	—	—			46	1	2
Engineering & Superintendence.	—	—			384	5	0
					3,107	6	10

WIGAN.

Mr. John Law Hunter, borough surveyor, has given me the following information as to drainage in Wigan:—

The average cost of draining cottages of about £3 or £4 rental, has been at an average of..	£1	1	0
Ditto ditto £7 or £8 rental...	1	11	0
Ditto ditto £14 or £15 rental	1	13	6

4,228 houses have been drained at a total cost of £8,796 19s. 10d., or an average cost, per house, of £2 1s. 4d.

In draining 4,228 houses, 36,960 lineal yards of earthenware pipes have been used, being an average of 8¾ yards per house. The earthenware pipes used are from 9 inches to 4 inches internal diameter.

Many of the drains have been in use several years, and there have not been any complaints of choking or stoppages.

Water-closets are not in general use in Wigan, but cess-pits, yards, stables, and house-sinks are drained. A general use of earthenware-pipe drains prevents rats living in the sewers and drains. They have neither food nor means of shelter.

DISTRICT OF WEST HAM, ESSEX.

Public Sewerage Works.

The parish of West Ham consists of the sub-districts of Stratford, West Ham, and Plaistow, and comprises an area of about 4,735 statute acres.

Population about 35,000, but is rapidly increasing. Annual rateable value, £135,000. The entire area is low and flat. The lowest surface area is near Hallsville, and is about four feet above Ordnance datum.

The highest surface area is near Forest-gate, and is about forty-five feet above Ordnance datum. The difference of level within the parish is, therefore, about forty-one feet.

A considerable portion of the parish is marsh, protected, by artificial embankments, from tidal waters and land floods, which rise to a height of from six to ten feet above the surface of the land.

This marsh land is intersected by ditches, and is under the jurisdiction of the Havering and Dagenham Commissioners of Sewers.

The distance from the outlet works to the end of the sewer near Forest-gate is about three and-a-half-miles; at Bow-bridge two-and-a-half miles; in Romford-road, two miles and three-quarters; in Barking-road, one mile and three-quarters; and in the Lilliput-road, Victoria Docks, one mile and a half.

The outlet works consist of a pumping establishment and a low water, or relieving flood-water sewer.

The pumping establishment is erected on land purchased by the Local Board at Canning-town, and consists of an engine-house, boiler-house, coal-store, work-shop, and engine-chimney, with pumping-wells, outlet-wells, and outlet-pipes.

Two condensing engines (of 40-horse power each), having 34-inch cylinders, and 6-feet stroke, have been provided and fixed. Each engine works two pumps of 48 inches diameter, and 3-feet stroke. The two engines are capable of lifting 30,000,000* gallons in 24 hours. The pumps are so arranged as only to lift to the level of the water in the river; the lowest lift is 8 feet, the highest lift is 22 feet.

The inlet and outlet pipes, to and from each set of pumps, are 30 inches diameter, having screw-down valves complete. Self-closing flap-valves are fixed on the outlet pipes at the river wall.

A low-water, or relieving flood-water outlet has been formed at Bow-creek, near Barking-road station. The river Lea at this point is nearly four feet lower, at low water of spring tides, than the bed of the river opposite the pumping works. This outlet, which is self-acting, discharges the flood-water for several hours each day without pumping. In the outlet-well adjoining the river, two self-closing flap-valves, similar to those at the pumping-outlet have been fixed, and, as a precautionary measure, one screw-down sluice has been placed in the manhole in Barking-road.

The larger main sewers are formed of brickwork; smaller sewers are of stoneware pipes. Cast-iron pipes have been used for crossing navigable rivers, and also for crossing marsh drains, and for the main outlets. Brick sewers are "egg shaped" on section, and vary in size from 5-feet 3 inches by 3-feet 6 inches, to 2-feet by 1 foot 4 inches. The whole of the brickwork is set in the best blue lias hydraulic mortar. Stoneware pipes are circular on section, and have half-socket joints. Cast-iron pipes are circular on section, and are formed with flanch or socket joints. Twenty-four thousand two hundred and twenty-seven (24,227) lineal yards of brick sewers; twenty seven thousand six hundred and ninety-eight (27,698) yards of stoneware pipe sewers; and two hundred and ten (210) yards of cast-iron pipes, making a total of fifty-two thousand one hundred and thirty-five (52,135) lineal yards, or twenty-nine miles and one thousand and ninety-five yards (29 miles 1,095 yards) have been constructed and laid within the district.

The sewers, throughout the district, have been designed with a view of obtaining the best practicable gradients, more especially for tributaries. In some cases, however, it has been necessary to lay the mains with a fall of not more than one in 3,520, or 18 inches per mile.

The sewers, on plan, have been laid in straight lines; and, on section, with regular gradients. At each change in direction, or alteration of gradient, a manhole or lamp-hole has been constructed, affording means for inspecting, and, when necessary, also for cleansing the sewers.

The main outlet-sewers in Canning-town have been laid level, and the inverts are formed of cast-iron, to allow of their being laid and formed under water.

Considerable difficulties were experienced in the construction of the sewers in some portions of the district, arising from loose, wet, spongy, and other unfavourable descriptions of sub-soil, and from other causes. Upwards of three miles of main sewers have been laid with cast-iron inverts, at or near the level of low water of spring tides, at the Barking-road outlet.

About 9,000 junctions for branch-sewers and house-drains have been provided on the main and tributary sewers. A careful account has been kept of these junctions, and has been placed in the hands of the Surveyor to the Board.

The main-sewer crossings, under three branches of the river Lea, consist of cast-iron pipes of two feet six inches, and two feet diameter. At each end of these cast-iron pipes under the rivers, a manhole is constructed with screw-down sluices, which may be put down in case of injury to the pipes under the rivers, and thus prevent flooding in the low districts.

The river-crossings were executed by Mr. Munday in a manner perfectly satisfactory to myself, and highly creditable to the contractor. By staging over the rivers, jointing the pipes, dredging the lines of mains, and lowering each entire length of pipe to its position, stoppage of traffic was rendered unnecessary, and claims for compensation, which might otherwise have arisen, were, by these arrangements, prevented.

Main and branch sewers have been constructed under the North Woolwich, the Barking and Tilbury, and Eastern Counties Railways, in eight separate places. The railway companies and their engineers afforded every facility for executing the works, and the crossings were completed without accident or stoppage of traffic.

On the sewers, as executed, there are 468 manholes, or means of access from the surface to the sewers for examination, for flushing, and, when requisite, for cleansing; and 197 lampholes for means of inspection, making, on an average of the entire length, one opening to the sewers from the surface of street or road, at about each seventy-eight lineal yards. Manholes have step-irons, flushing-grooves, and moveable iron covers complete. Lampholes have moveable iron covers. There are 251 ventilating-shafts provided on the sewers. These shafts are so arranged as to prevent road-drift falling into the sewers and impeding the flow. Sewer-gases are passed through wire baskets containing charcoal, and by this means are rendered innoxious. Seven hundred and eighteen (718) gullies have been fixed within the districts. The gullies are so constructed as to prevent solid or other improper substances passing into the sewers.

Flushing arrangements are of three classes:—First, by the admission of water into the sewers through sluices, hose-pipes, or valves; second, by screwing down fixed sluices built in certain manholes, allowing the sewage water to accumulate, and suddenly raising the sluice; and, third, by inserting loose paddles in the grooves provided in nearly all the manholes. Thirteen flushing valves and forty-two flushing-sluices are fixed in the sewers. By one or other of these arrangements, the whole of the sewers within the district may be flushed. About 310 feet in length of river wall has been put in, bounding the land belonging to the Local Board. This wall is constructed of brick and concrete, coped with stone, and is sound, firm, and calculated to be enduring. A wharf has been formed, at which coals for the engines are landed, but there is space for other traffic.

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* 30,000,000 gallons, equal to 300,000,000 lbs., or 133,928 tons.

West Ham.—Particulars of Cost.

			Amount.	Total.
Brick Sewers.				
Ft. In. Ft. In.	Yds.	Yds.	£ s. d.	£ s. d.
5 3 by 3 6	1117	...	3901 6 10	
4 6 ,, 3 0	2562	...	7476 4 0	
3 9 ,, 2 6	1463	...	4085 9 3	
3 0 ,, 2 0	7588	...	12376 7 11	
2 6 ,, 1 8	3182	...	5566 7 7	
2 3 ,, 1 6	8231	...	9156 17 11	
2 0 ,, 1 4	84	...	59 15 6	
Total Brick Sewers.........	...	24227	......	42622 9 0
Earthenware Pipe Sewers.				
15 inches diameter	10646	...	6671 14 11	
12 ,, ,, ...	16564	...	7061 2 10	
9 ,, ,, ...	488	...	142 12 7	
Total earthenware pipe sewers.	..	27698	......	13875 10 4
Cast-iron pipes for river crossings, &c....................	...	210		
Total length of sewers ... or 29 miles 1095 yards.	...	52135		
	No.	No.		
Manholes & ventilating shafts ...	232	...	3455 5 4	
Manholes	236	...	3160 4 3	
Lampholes & ventilating shafts..	15	...	97 8 3	
Lampholes	182	...	1008 9 8	
		665		7721 7 6
Gullies & pipes fixed complete...	...	718	... ..	3185 14 5
Outlet works, pipes, valves, &c.			......	1754 14 5
River wall, wharf, and roads, at engine-house, and repairing roads			......	2677 9 2
Engine-house, boiler-house, chimney, and other works in connection therewith			......	5098 6 10
River crossings			......	1644 6 7
Engines, boilers, and pumps			......	3978 9 10
Cost of Works.				82558 8 1
Engineering and superintendence			6161 9 8	
Land and compensation, and law charges ...			2999 8 8	
Coals and tallow, &c., for engines			303 5 3	
				9464 3 7
Total cost			... ... £	92022 11 8

N.B.—This amount includes purchase of implements, tools, and materials in the hands of the Local Board.

ALNWICK.

First Class House.—Rental £40 per Annum.

Water Supply.	Price not Fixed.	Price Fixed.	Total Cost Fixed.
	s. d.	s. d.	£ s. d.
143 lineal feet of 1 inch galvanised tube...	0 7½	0 10½	6 5 1
56 ,, ¾ ,,	0 5¼	0 8¼	2 4 8
34 ,, ½ ,,	0 4½	0 7½	1 1 3
16 in. of lead pipe for water closet pan...	0 10	...	0 0 10
3 in. of india rubber tubing for ditto. ...	1 1	...	0 1 1
1 ¾-in. self-closing ferrule cock for do....	7 4	...	0 7 4
1 1-in. elbow ferrule with union joint ...	3 10	...	0 3 10
1 1-in. elbow piece	1 6½	...	0 1 6½
2 ¾-in. ,, ...	1 0	...	0 2 0
5 ½-in. ,, ...	0 7½	...	0 3 1½
1 1-in. socket piece	1 1	...	0 1 1
2 ¾-in. ,, ...	0 8	...	0 1 4
2 ½-in. ,, ...	0 6	...	0 1 0
1 1 to ¾-in. taper piece	1 1	...	0 1 1
1 1-in. T-piece	1 7	...	0 1 7
2 1 to ½-inch T-pieces	1 7	...	0 3 2
1 1-in. stop-cock..	7 11	0 6	0 8 5
1 stop-cock case	4 6	1 6	0 6 0
1 1-in. screw plug, 9d.; 1 ½-in. do., 4½d.	1 1½	...	0 1 1
1 ½-in. bib tap	2 10	0 6	0 3 4½
			11 18 11½
Sewerage.			
211 lineal feet of 6-in. earthenware pipe	0 5½	Price varies according to depth.	12 0 9
68 ,, 4-in. ,,	0 4		
6 ,, 6 to 4 in. junction pipe	1 6		
3 ,, 6 to 6 in. ,,	1 6		
1 ,, 6 to 4 in. taper pipe ...	1 4		
2 ,, 6 in. bend pipe	1 6		
1 water closet pan and fan, old seat refixed	8 6	17 0	0 17 0
3 earthenware yard sinks...	6 0	9 6	1 8 6
2 6-in. bell traps	2 6	8 6	0 17 0
Sewerage...	...	...	15 3 3
Water	...	...	11 18 11½
Total...	...	...	27 2 2½

Second Class House.—Rental £15 per Annum.

Water Supply.	Price not Fixed.	Price for Fixing	Total Cost Fixed.
	s. d.	s. d.	£ s. d.
6 lineal feet of ½-in galvanised tube ...	0 4½	0 3	0 3 9
72 ,, ¾-in. ,, ...	0 5¼	0 3	2 9 6
16 in. lead pipe for water closet pan	0 10	...	0 0 10
3 in. india rubber tubing for ditto.	1 1	...	0 1 1
1 ¾-in. self-closing ferrule cock for do. ...	7 4	...	0 7 4
1 ¾-in. elbow ferrule, with union joint ...	2 3½	...	0 2 3½
3 ¾-in. elbow pieces	1 0	...	0 3 0
2 ½-in. ,, ...	0 7½	...	0 1 3
7 ¾-in. socket pieces	0 8	...	0 4 8
3 ½-in. ,, ...	0 6	...	0 1 6
1 ¾ to ½ in. T-piece	1 2	...	0 1 2
1 ½-in. bib tap	3 4	0 6	0 3 10
1 ¾-in. stop cock	5 2	0 6	0 5 8
1 stop cock case	4 6	1 6	0 6 0
			4 11 10½
Sewerage.			
47 lineal feet of 6 in. earthenware pipe ...	0 5½	Price varies according to depth.	4 0 1
12 ,, 4 in. ,, ...	0 4		
7 ,, 6 to 6 in. junction pipes..	1 6		
2 ,, 6 in. bend pipe	1 6		
1 ,, 4 in. bend pipe	1 0		
5 ,, 4 to 6 in. taper pipe ...	1 4		
3 earthenware sinks	6 0	3 6	1 8 6
2 6-in bell traps, with earthenware dishes	2 6	5 0	0 10 0
1 water closet pan and fan, with new seat	8 6	14 0	1 2 6
1 ash pit, filled up and repaved	5 0	...	0 5 0
Additional clay puddle in passage	...	...	0 5 0
Sewerage..	...	...	7 11 1
Water	...	...	4 11 10½
Total...	...	...	12 2 11½

Third Class House.—Rental £7 per Annum.

Water Supply.	Price not Fixed.	Price for Fixing	Total Cost Fixed.
	s. d.	s. d.	£ s. d.
10 lineal feet of ¾-in. galvanised tube ...	0 5¼	0 3	0 6 10½
14 ,, ½-inch ,, ..	0 4½	0 3	0 8 9
12 in. of ¾-in. lead pipe for water closet pan	0 10	..	0 0 10
3 in. of inddia-rubber tubing for ditto. ...	1 1	...	0 1 1
1 ¾-in. self-closing ferrule cock for do. ...	7 4	...	0 7 4
1 ½-in. elbow ferrule, with union joint ...	1 6½	...	0 1 6½
1 ¾-in. ,, ,, ...	2 3½	...	0 2 3½
1 ¾-in. socket piece	0 8	...	0 0 8
2 ½-in. elbow pieces	0 7½	...	0 1 3
3 ½-in. socket pieces	0 6	...	0 1 6
1 ½-in. bib cock	3 4	0 6	0 3 10
1 ¾-in. stop-cock	5 2	0 6	0 5 8
1 ½-in. stop-cock	3 6	0 6	0 4 0
2 stop-cock covers	4 6	1 6	0 12 0
			2 17 7½
Sewerage.			
32 lineal feet of 6-in. earthenware pipe...	0 5½	Price varies according to depth.	2 6 7
14 ,, 4-in. ,, ...	0 4		
1 ,, 6-in. syphon	4 6		
1 ,, 6 to 6 in. junction pipe ...	1 6		
2 ,, 4 to 6 in. taper pipe ..	1 4		
1 ,, 6-in bend...	1 6		
1 kitchen sink	4 6	5 0	0 9 6
1 4-in. bell trap for ditto.	1 6		0 1 6
1 earthenware sink, basin, and syphon ...	6 0	3 6	0 9 6
1 water closet pan and fan, old seat ...	8 6	8 6	0 17 0
1 6-in. bell trap	2 6	6 0	0 8 6
Waste-pipe to kitchen sink	...	...	0 6 0
Ash pit filled up and repaved	...	...	0 5 0
Sewerage...	...	...	5 4 4
Water	...	...	2 17 7½
Total...	...	...	8 1 11½

Cost of Private or House Drainage Works.

Alnwick.

The cost of house drainage works necessarily depends, in a great measure, upon the position of the premises drained with regard to the main sewer; the length of drains required, the depth at which they are laid, and the character of the subsoil.

The following particulars are given as the average cost of house drainage works in the towns named:—

	£	s.	d.
Houses of £40 rental, with one water-closet, cost about	15	3	3
Houses of £15 rental, with one water-closet, cost about	7	11	1
Houses of £7 rental, with one water-closet, cost about	5	4	4

The length of drain to each house in Alnwick, taken on an average of 516 houses, is 25½ yards.

The following list of loans, sanctioned under the Public Health Act (1848) and the Local Government Act (1858), will show to some extent the progress that has been made in carrying out sanitary works in England during the last twelve years:—

		£	s.	d.
1850	15th June to 31st December	41,665	0	0
1851	1st January to 31st December	103,706	0	0
1852	,, ,,	246,470	0	0
1853	,, ,,	500,740	0	0
1854	,, ,,	599,893	0	0
1855	,, ,,	424,126	6	3
1856	,, ,,	522,703	16	5
1857	,, ,,	312,612	11	0
1858	,, 1st September	204,261	13	0
		£2,956,178	6	8

Amount of loans sanctioned under the Local Government Act:—

	£	s.	d.
1858, 1st September to 12th August, 1859	260,905	13	0
1859, 12th August to 21st August, 1860	280,259	7	4
1860, 21st August to 1st August, 1861	356,192	0	0
1861, 1st August to 1st March, 1862	129,998	0	0
	1,027,355	0	4
	2,956,178	6	8
	1,027,355	0	4
	£3,983,533	7	0

This amount has been borrowed by 178 towns or districts.

Improvement in social and in sanitary matters has made rapid progress of late. Within the last half century land drainage and town sewerage have ripened into sciences. From rude beginnings, insignificant in extent, and often injurious in their effects, they have become of the first importance. The introduction of machinery to make land drain pipes and town sewerage pipes, gave a forward movement to civilisation. Land, by judicious draining and improved cultivation, is frequently doubled in value, and town sewerage, with other social regulations, frequently prolong human life from 5 to 50 per cent. as compared with previous rates in the same districts, and, within my own knowledge, house property throughout a whole town is reputed to have been increased 25 per cent. in value by such works. Agues and typhoid fevers are reduced or entirely banished. John Howard, by his labours, has shown to the world what could be done for gaols and for criminals; Edwin Chadwick for town sewerage, and Florence Nightingale for camps, barracks, and hospitals.

With respect to the beneficial effects of sanitary measures, Sir. G. C. Lewis, in moving the Army Estimates, said—"There have been a large number of improvements introduced for the purpose of bettering the moral and sanitary condition of the private soldier. In the first place, there has been a great improvement in barracks; and I am happy to say that these improvements in barracks have not been unattended with important results. I will read for the committee some statistical returns, which I believe to be authentic, and which will show a marked improvement as regards the rate of mortality in the army. The returns are taken for two periods for an average of six years—1830-36, and 1854-60, giving the number per thousand. The annual mortality of the household cavalry from 1830 to 1836 was at the rate of 14 per 1,000; in the latter period it was only 5 per 1,000. In other cavalry it was at the first period 15 per 1,000; in the latter only 6 per 1,000. Royal Artillery, 15 per 1,000 in the first period; in the latter only 7 per 1,000. Foot Guards, 21 per 1,000 in the former period; and only 9 in the latter. The Infantry of the Line 17 per 1,000 in the former period; and only 8 per 1,000 in the latter. The returns for the colonies, of all forces, for the same periods, showed that for the former—namely, from 1830 to 1836—the mortality at Gibraltar was 22 per 1,000; but in the latter period only 9. Malta

STATEMENT

Showing the Population, Number of Houses, Length of Sewers, Number of Manholes, Lampholes, and Gullies, and the Total Cost of the Public Sewerage Works in the several Towns Named; together with the Amount, and Rate in the £ required per Annum to Repay the Principal and Interest in Thirty Years.

Works Devised and Completed by Robert Rawlinson, Civil Engineer.

TOWN.	Population.	Number of Houses.	Total Length of Sewers.	Number of Manholes.	Number of Lampholes.	Number of Gullies.	Total Cost of Works. Amount.	Total Cost of Works. Per House.	Total Cost of Works. Per Head.	Amount per Annum to Repay Principal and Interest in Thirty Years. Total.	Amount per Annum… Per House.	Amount per Annum… Per Head.	Amount per Annum… Rate in the £ per ann.
			Yards.				£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Alnwick ...	7,016	947	11,132	54	28	140	4,327 18 10	4 11 4	0 12 4	250 5 10	0 5 3	0 0 8½	0 0 5
Berwick ...	10,067	1,451	7,995	40	51	128	5,649 1 4	3 17 10	0 11 3	326 14 0	0 4 5½	0 0 7¾	0 0 3½
Carlisle ...	26,310	4,113	24,079	131	99	366	23,310 6 7	5 13 4	0 17 8	1,348 2 3	0 6 6¼	0 1 0¼	0 0 6
Chorley ...	12,684	2,337	13,205	79	47	282	10,546 4 7	4 10 3	0 16 8	609 19 8	0 5 2¾	0 0 11½	0 0 6
Lancaster ...	14,604	2,698	12,820	126	118	288	9,245 5 7	3 8 6	0 12 8	534 13 9	0 3 11¼	0 0 8¾	0 0 4½
Morpeth ...	4,096	580	7,171	22	—	82	2,720 0 9	4 13 9	0 13 3	157 6 2	0 5 3½	0 0 9	0 0 6
Ormskirk ...	5,548	942	6,839	28	—	72	2,982 8 7	3 3 4	0 10 9	172 9 8	0 3 7¾	0 0 7½	0 0 4
Penrith ...	6,668	1,344	7,152	15	99	48	3,109 0 0	2 2 11	0 9 4	179 16 1	0 2 5¼	0 0 6½	0 0 3
Tynemouth	29,170	4,478	17,871	122	154	559	12,404 18 5	2 15 4	0 8 6	717 8 5	0 3 2	0 0 6	0 0 5
Worksop ...	7,020	1,567	12,429	81	48	136	5,871 19 7	3 14 11	0 16 9	339 12 0	0 4 4	0 0 11½	0 0 6
Totals ...	123,183	20,457	120,693	698	644	2,101	80,168 3 3	—	—	4,636 7 10			
Averages ...	—	—	—	—	—	—	—	3 18 4½	0 13 0	—	0 4 6½ Nearly.	0 0 9 Nearly.	0 0 5 Nearly.

Average Length of Main Sewer per House = 5·9 yards.

N.B.—Population to Houses about six to one; Private Works, such as house drains, yard sinks, soil-pans, &c., cost about equal rates to he above; that is, it is found from experience that the cost of private works of drainage, and of Water Supply Fittings, is about equal to the cost of Public Works of Sewerage and Water Supply.

showed a diminution from 18 to 14 per 1,000; Ionian Islands, from 27 to 9 per 1,000; Bermuda, 35 to 11 per 1,000; Canada, 20 to 10 per 1,000; Jamaica, from 128 to 17; Ceylon, from 74 to 27. These are great results, and they are owing to the changes made in the sanitary condition of the army."

Since the year 1840 great and beneficial sanitary improvements have been effected in English towns. An annual mortality of 44 in the 1,000 has been reduced to 27, and 30 to 20, and even as low as 15. Human life has more value in England than in any other country in the world, entirely due to better sanitary arrangements.

PARTICULARS OF SEWERS AS EXECUTED IN THE CITY AND TOWNS NAMED.

	Depth to invert of sewer.	Thickness of Brickwork.	Number of bricks per lineal yard.	AVERAGE COST OF SEWERS PER LINEAL YARD.						
				Birmingham.	Buxton (in Rock).	Carlisle.	Chorley.	Tynemouth.	West Ham.	Worksop.
Brick Sewers:—	Ft. in.	Ft. in.		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
4 ft. 6 in. by 3 ft. 0 in. ...	10 0	0 9	432	1 11 6	—	—	—	—	2 3 3	—
3 ft. 9 in. by 2 ft. 6 in. ...	10 0	0 9	384	1 8 0	—	1 3 6	1 14 2	—	1 18 1	—
3 ft. 0 in. by 2 ft. 0 in. ...	10 0	0 9	304	1 6 0	—	1 2 6	1 5 5	—	1 8 8	—
2 ft. 3 in. by 1 ft. 6 in. ...	10 0	0 9	248	0 19 0	—	0 18 6	1 4 8	1 5 6	1 3 9	0 19 9
1 ft. 6 in. diameter ...	10 0	0 9	208	0 18 0	—	0 16 0	0 17 6	—	—	—
3 ft. 9 in. by 2 ft. 6 in. ...	10 0	0 4½	172	0 17 0	—	—	—	—	—	—
3 ft. 0 in. by 2 ft. 0 in. ...	10 0	0 4½	136	0 16 0	—	0 17 6	—	—	0 19 8	—
2 ft. 3 in. by 1 ft. 6 in. ...	10 0	0 4½	112	0 12 0	—	0 15 0	0 11 10	0 18 6	0 17 6	0 13 8
1 ft. 6 in. diameter............	10 0	0 4½	88	0 10 0	—	0 14 0	0 10 11	—	—	—
Earthenware Pipe Sewers—										
15 inches diameter............	10 0	—	—	0 9 4	0 11 3	0 9 6	0 9 10	0 9 2	0 11 10	0 5 9
12 inches do.	10 0	—	—	0 7 8	0 10 4	0 7 9	0 8 2	0 7 5	0 9 4	0 4 6
9 inches do.	10 0	—	—	0 6 5	0 9 0	0 5 9	0 5 4	0 5 7	0 7 3	0 3 9

QUESTIONS AND ANSWERS RELATIVE TO SEWERAGE WORKS IN THE TOWNS NAMED.

MARCH, 1862.

QUESTIONS.	ALNWICK.	BERWICK-ON-TWEED.	BUXTON.	CARLISLE.	LANCASTER.	WORTHING.
What is the average annual expenditure incurred below the surface of the streets, in cleansing the sewers?	Nothing.	From £10 to £12.	Nothing has been expended.	None.	£4 in four years, or £1 per annum.	Nothing. Works executed in 1854.
The number of sewers choked per annum, if any, and the causes of stoppage?	About 20 house-drains per annum. Sand, dish-cloths, and sticks.	Four or five, from offals of animals, ashes, sand, gravel, &c.	None.	Not more than 2 or 3 per cent. in 9-inch pipe sewers, owing to flat gradients and backing up of floods. Direct stoppages are caused by improper substances being passed into the drains.	Average five at blank ends. Main sewers never stopped.	None.
Have you any complaints of sewage injuriously affecting fish in the river or stream into which it is passed?	No.	No.	No.	No. Any complaints on this head have been in consequence of an overflow from the sleeper dipping tanks of a railway company passing into the sewers. Waste creosote.	No.	The sewage does not go into a river or stream, but out to sea.
Average annual cost of flushing sewers, if any?	£2 per annum.	Flushed occasionally by the Surveyor or his assistant, but at no additional cost to the Board.	They have only been flushed once during the last year.	Water given by Water Company. Flushing and maintenance of sluices attended to by scavengers.	£5 (labour only).	About £13.
Do the sewers generally serve the purposes intended?	Yes, if properly used.	Yes.	The main sewers are all in good order and work well.	Yes.	Yes.	Yes.

It has been said, "as are the people so will be the government," but my experience leads me to the conclusion that bad government necessarily makes a bad people. Temptation is the parent of vice, and opportunity the broad road leading to destruction. A little leaven of evil leavens the whole mass. Lord Shaftesbury, through the entire of his most valuable life, has appreciated the facts stated, and has devoted himself to teaching, by example and by precept, to preventing as well as to reforming. His "Common Lodging Houses Act" has probably internal fires of destruction made the earth tremble done more good than any other law of modern times, by removing temptation, and, therefore, preventing evil. Before the passing of this act there was no check to vice in its most disgusting forms. I only indicate that which I have seen, and cannot, consistently with the decencies of society, openly describe. I can only say that our civilisation resembled those volcanic regions where the beneath the feet of the dwellers on the treacherous surface—a sudden outbreak might at any time take place, and overwhelm all in ruin.

Social improvement must begin in the upper circles of society, that it may descend in precept, and be enforced by example. Our own good Queen Victoria understands this. The great and wise Prince we have recently lost, and whom we so deeply mourn, fully understood this. The deep-thinking, far-seeing ruler, who sits on the Imperial throne of France, appreciates the fact. In the International Exhibition of 1851 the model cottages of Prince Albert probably worked more human good, by encouraging home improvements, than all the glitter of precious stones, the wealth of jewellery, and the subtle refinements of art. The poor are utterly powerless to help themselves in matters of sanitary improvement. They cannot build their own houses, but must inhabit such as are provided by others. They cannot make the laws, neither can they administer such laws as are made. If the laws are wise they receive the benefits, if otherwise, they suffer. Social science, as it is termed, must be administered by the State, and this Lord Brougham fully understands. It will be an evil day for society when Government divests itself of all executive power in social and sanitary matters. Freedom is a glorious thing, but license, to initiate and work evil against the general body of society for private gain, is neither a safe nor a desirable state of freedom. A state which can tolerate cesspools, beerhouses, gin palaces, and can license dancing saloons, must bear with vice, crime, lunacy, and pauperism in excess.

Wise Imperial laws are required, and honest and intellectual administration nationally and locally to secure sanitary progress, and the greatest amount of political contentment, commercial prosperity, health and social comfort to a nation.

DISCUSSION.

Dr. Stenhouse, F.R.S., had listened with great pleasure to Mr. Rawlinson's able paper, but would not presume to offer an opinion upon the engineering part of the subject. There was one question, however, in which he had taken great interest, that was as to the use of charcoal air-filters for ventilating sewers. It was towards the close of the year 1853 that he first directed attention to the subject of charcoal in connection with the ventilation of impure atmospheres, and at that time he found that the opinions then prevalent with regard to the properties of that agent were in many respects very erroneous. Charcoal was generally represented to be an antiseptic, whereas he found the contrary was the case—that instead of preventing decomposition it was an agent in promoting it, from its capability of absorbing large quantities of gases. He also found that the charcoal would operate for almost any length of time, because it was not acted upon by the gases with which it came into contact. The properties of charcoal when employed for these purposes were first illustrated by its employment in the form of respirators, for when a charcoal respirator was placed over the mouth it was found that a person could breathe noxious gases for some time without injury. The atmospheric air passed through the charcoal, but the poisonous gases were retained and gradually oxidised. Dr. Stenhouse exhibited an apparatus composed of charcoal fixed between perforated zinc plates, which he had employed in the ventilation of public courts and rooms, and which he said had been used with excellent effect in the courts of the Guildhall and Mansion-house, as well as elsewhere. The apparatus had been in operation seven years in the justice room at the Mansion-house, and during that period the charcoal had been changed only once. A few years afterwards that plan, with some modifications, was adopted by Mr. Rawlinson, Dr. Letheby, and Mr. Haywood for the ventilation of sewers. He was happy to say the subject was beginning to attract general attention, and he believed in the course of a few years charcoal ventilation would become almost universal.

Mr. Rawlinson called attention to one of the charcoal boxes of the description used by him in the sewers at West Ham. Since the first application of the system he had thought it expedient to have the charcoal broken into smaller pieces than he had first employed, and when this was done its action was much more effectual.

The Earl of Essex said he was amongst the earliest of those who had attempted to utilise the sewage of towns for agricultural purposes, as distinguished from the ammoniacal liquids derived from the farm premises, which, being much stronger than town sewage, and containing a much larger quantity of fertilising agents, were applied to the land in smaller quantities. He was one of the first to try the effects of actual sewage on land, and he suffered the usual fate of pioneers of improvements by having gone to a much greater outlay than was necessary, from which it resulted that the profits upon the experiment were much less than they would otherwise have been. In the outset he made a great mistake in supposing that the sewage of a town (Watford), with 4,000 inhabitants, would be sufficient to irrigate upwards of 230 acres of land, over which he laid pipes, for he had since found that the whole sewage of that town would not be sufficient for more than sixty or seventy acres, consequently the benefits of the system were lost upon 150 acres over which the pipes had been laid; and at the present time the larger portion of the pipes were lying useless from the sewage supply being insufficient for so extensive an area. In other respects also he made mistakes which were very common in such matters. His steam power was less than it ought to have been, and the main pipes he laid down were too small. He believed if the system had been carried out with more practical judgment it would have paid very well. At present it paid tolerably well, inasmuch as with all the unnecessary outlay he had incurred he could put the sewage upon the land at a cost of five farthings per ton. His belief was that if the outlay had been regulated by the amount of land which the sewage supply at his command was capable of irrigating, he should have done it at a cost, at the outside, of three farthings per ton, which would have given him most satisfactory results, and he was sure any agriculturist who could obtain the sewage at that rate, would never regret the outlay. He had employed this method of irrigation for meadow land immensely to his satisfaction, and by far the greatest results had been produced upon Italian rye grass. He could state that during one summer, upon seven acres of Italian rye grass, he fed thirteen bullocks, seven horses, several ponies, and a large number of pigs. Five of the bullocks were sold in a fat condition in July. During a temporary stoppage of some of the works he fed the bullocks upon cake, but these did not pay better than those which had been fed upon the rye grass alone. He had tried sewage irrigation to crops of mangold-wurzel with great success, and from seven acres which had been transplanted, owing to the plants being very irregular, he obtained a crop of 47 tons per acre. He would add that he had tried the system upon a smaller scale upon wheat crops, relative to which the opinion prevailed that the application of this description of manure increased the quantity of straw without adding to the bulk of the grain. He tried the comparative results of irrigation and non-irrigation on four acres of wheat. Two acres were irrigated to the extent of 60,000 gallons of sewage, and two more were allowed to remain without irrigation; and the relative produce per acre was as follows:—On the irrigated land, 5 loads of straw at 30s. per load, £7 10s.; and 53 bushels of wheat at 6s. per bushel, £15 18s., making a total return of £23 8s. On the non-irrigated land the total return per acre was £20 6s. 6d., leaving a surplus in favour of the irrigated land of £3 1s. 6d. Allowing for the cost of irrigation at the extreme price of five farthings per ton, the quantity put upon an acre cost 14s., and deducting that from the £3 1s. 6d., there was a clear balance of £2 7s. 6d. in favour of the irrigated land. He believed the system judiciously applied would be found to be extremely beneficial.

Mr. Campbell (of Rugby) would offer a few observations relative to the subject introduced by the noble earl who had just sat down. He (Mr. Campbell) had employed the sewage of Rugby on his land for the last six years. He had been a sufferer from the causes mentioned by the noble earl, although not to the same extent. In the first application of the sewage he did not understand the proper way of using it. He contracted with the lessee of the sewage for £1 per acre for 150 acres, for which five dressings of the town sewage were to be put on that land, which at the first seemed to be a very good bargain, but the question afterwards arose as to what quantity should be considered a dressing. After some discussion between himself and the lessee the point was referred to the chairman (Mr. Mechi), who decided upon 9,000 gallons per acre, whilst he (Mr. Campbell) contended for a much larger amount, but that point was given against him. Then there was the consideration as to the constituents of the sewage, and upon that point he came to the conclusion that the application of 9,000 gallons, or even the 45,000 gallons for the five dressings per acre of sewage so largely diluted with water, produced very little fertilising effect. He was well acquainted with the irrigation of the Edinburgh meadows. The quantity applied was very large—he believed as much as 8,000 tons per acre.

Mr. **Edwin Chadwick**.—Sixty inches per acre.

The **Chairman** remarked that that would be equal to 6,000 tons.

Mr. **Campbell** had taken his facts from the blue book, but there was a difference between the Scotch and English acre. Some present might not be aware of the enormous rents which were paid for that irrigated land in Edinburgh. When on a visit there last summer he was informed by the proprietor that one cow-keeper paid him as much as £40 per acre for six acres of that land. His (Mr. Campbell's) experience at Rugby had led him to abandon the application of the system to ploughed land, except in very dry seasons to some particular green crop. He had no doubt, if he were to apply the whole £150 worth of sewage to 8 or 10 acres of meadow land, he should obtain large crops of grass equal to those at Edinburgh; but it became a question at what amount of expense they could obtain those large results, because they might "buy gold too dear." The sewage of Rugby was, in the first instance, imagined to be so extremely valuable that the Board of Health thought fit to charge a rental of £50 for it. He thought that was a wrong thing to do. They ought to have been content with conveying the sewage to a large tank, half a mile from the town, and allowing it to be applied to the land without any charge to the agriculturist. A prevalent error in these cases was the laying the pipes over a greater extent of land than could be profitably irrigated with the present quantity and quality of sewage. In the case of Rugby, he did not believe they got the whole of the sewage, inasmuch as from the small dimensions of the main pipes, he thought a great portion went back to the tank again. He was induced to think that the sewage of Rugby, from a population of about 7,000, would not be sufficient for more than from 40 to 50 acres of land.

The **Chairman** inquired what was the highest price Mr. Campbell got for his Italian rye grass.

Mr. **Campbell** replied that it was not saleable, as people did not appreciate its value. For his own part he cultivated it from a wish to have as large a supply of green fodder for his cattle over as long a period of the year as possible.

The **Chairman** inquired what was the amount of the grass crop on Mr. Campbell's land.

Mr. **Campbell** replied from 30 to 40 tons per acre had been obtained in some cases, but this was not equal to Edinburgh. Until last year the application of the sewage had been principally by the hose, but he believed better results were obtained on Italian rye grass by the distribution of liquid from the cow houses by carts, with the addition of the stronger ammoniacal liquor from the gas works, than from the town sewage with hose and pipe.

Mr. **Blackburn** said, from what had fallen from the last speaker, it might be supposed that the enormous amount of sewage used at Edinburgh was necessary to produce the results there obtained, but instead of 6,000 tons, (the quantity there used on the shedding and open gutter system,) the land which had last year realised the largest rent, viz., £40 an acre, received only 2,000 tons, and that distributed by gutta percha hose. It might be inferred from this that the smaller quantity applied by hose under proper conditions, raised as much grass as the larger quantity applied on the shedding system. It might also be seen that a great waste was the result of the larger application, and that the sewage, after having passed over the land, had not parted with all its fertilising properties, from the fact of the soil not having been able to filter so large a quantity. He had seen the application at Rugby alluded to by Mr. Campbell, and which had certainly been carried out in a very imperfect manner. The tank, pump, and pipes were all badly arranged, and out of proportion, thereby involving heavy working expenses; the sewage had been applied to land unfitted for its reception; the ridge and furrow surface was not suited to receive the sewage from the hose, and instead of a uniform absorption by the soil all over its surface, that which was delivered on the ridge very quickly found its way into the furrow, and so produced a most unequal growth. They had entirely overlooked the importance of selecting proper grasses, and had taken the land for the purpose planted with the common natural grasses, which, although well-suited to its original condition, were not at all fitted to realise the best results under the very altered circumstances in which the soil was now placed. In corroboration of this, he might state that on a portion of the meadows near Edinburgh, a plot which, when growing the natural grasses, was let at a yearly rent of £13, was broken up, relaid, and sown with a variety of grass suited to irrigation, and the first season realised a rent of £27, all conditions remaining the same except the variety of the grass grown. This was an important fact, which in most cases had been overlooked.

Mr. **Haywood** (Engineer to the City Commissioners of Sewers) remarked that the paper dealt with many topics which could only be properly treated before a professional audience, but as there were, no doubt, many unprofessional gentlemen present he would, in the first place, ask Mr. Rawlinson what was the meaning of the somewhat startling diagram which he saw before him [alluding to the drawing representing a form of sewer which was nearly blocked up with filth]? He could hardly suppose it was intended to represent a sewer; and he would ask Mr. Rawlinson whether he had ever seen a sewer in that condition?

Mr. **Rawlinson** said the drawing was copied from a published diagram, and he would rather have left out the representation of the accumulated deposit. He only referred to it as showing a form of sewer in which large accumulations of solid matter were liable to take place. He had himself seen sewers in as bad a condition as was shown in the drawing alluded to.

Mr. **Haywood** wished it had never been produced, because he believed nobody but Mr. Rawlinson ever saw a sewer in the condition there represented.

Mr. **Rawlinson** remarked that Mr. Haywood managed the district under his charge so well that he could not imagine such a state of things could exist out of it.

Mr. **Haywood** would call attention to the difficulty in which the modern system of the sewerage of towns had placed them, which was, that almost every rivulet in the country was more or less polluted, and they did not know how to obviate that difficulty, inasmuch as the agricultural community had not yet found proper means of utilising the sewage matters. If they did not, however, the whole of the large towns of England would be in a very serious condition, for this reason—that they were compelled to drain into the rivers, which were thus polluted to a most dangerous extent.

The **Chairman** believed that was the case at Birmingham.

Mr. HAYWOOD—Not only was it the case in Birmingham, but in many other parts of the country. With the large population of Birmingham that would be one of the principal instances of the difficulty to which he alluded. But there were smaller towns which were in a similarly unfortunate condition. He might mention the fact that at the present time the town of Croydon was under an injunction to restrain it from discharging the drainage of a population of 18,000 into the river Wandle. The local authorities there had hired 300 acres of land, on which to distribute the sewage of the town; but even that large area was found to be wholly inadequate to prevent the pollution of the river to such an extent as to lead to the issuing of an injunction. Therefore, he said, the modern system of sewerage had placed them in a tremendous difficulty, which would not be met by allowing the agriculturists to take just as much of the sewage as they were in a position to dispose of upon the land, but it would rest upon the Local Board of Health to provide a sufficient acreage over which to distribute the sewage matters; and what would be the area required for a town like Birmingham, with its 400,000 inhabitants, when they found that, in the case of Croydon, 300 acres were not sufficient for a population of only 18,000? It was one of those difficulties which, if not met, he believed in the course of years would compel them to go back to the old system of cesspools. There was one other subject to which he would allude—that was the application of charcoal, as an agent for the ventilation of sewers. He believed the priority of that application was due to Mr. Rawlinson, and he had great pleasure in stating that fact. In the reports of Dr Letheby and himself, as to the application of charcoal, he was sure that no fact had been concealed, but there was at present great difficulty in ascertaining the results of that experiment. The prevention of the escape of effluvium into the atmosphere above the sewers was a well-known result, and the deodorising properties of charcoal were also well known; but the question to be considered was, what would be the ultimate effects within the sewers? Would it or would it not intercept the necessary action of the atmosphere? Would it or would it not, in the long run, render the atmosphere of the sewers so deadly that men on entering them would be struck down suddenly, as had been the case in a recent instance? On that subject he was unable to give an opinion, but these questions had occurred to his mind. His present impression was that the plan could be beneficially applied as regarded preventing the escape of effluvium from the sewers, but whether or not it would result in rendering the sewers more deadly internally he was not at present able to say.

Mr. Alderman TOWLE (of Oxford) expressed his opinion generally that in the present largely diluted condition of the sewage of towns, its application to the land would produce very little result. There would be no question as to the fertilising properties of house sewage if it could be obtained without so large an admixture of the water which conveyed it away.

Mr. WM. HAWES thought, owing to the presence of the gentleman who occupied the chair that evening, the discussion had rather been confined to the agricultural view of the question, than to the more practical view in which they, as inhabitants of the largest city in the world, were interested. If there was one point of view in which the perfect sewerage of a town was interesting to them, it was as it affected the improvement of the health and comfort of the great masses of the working population who had no choice as to residence—who were obliged to take such ill-drained and ill-ventilated dwellings as they could find, and who were compelled to suffer all the diseases which were incidental to those circumstances. As regarded the improved health of the working classes of the metropolis, he believed good systems of drainage were a most important element. In the first place they not only saved the cost always attaching to illness—they not only spared the anxiety which was involved in sickness in a working-man's family—but they increased the muscular powers of the labouring population of the country, inasmuch as every working man was efficient in proportion to the amount of health he enjoyed. But there was another point in which they were, perhaps, even more directly interested, viz., the increased value of property in all cases where drainage had been attended to. There was one town in particular (Worthing) mentioned in the paper, of which he could speak from his own personal knowledge. It was a watering-place, on the southern coast of England, which, a few years back, was hardly habitable for the want of drainage. Almost everybody who went there in the summer season left it again on account of the nuisance created by the natural drainage from the town passing through the shingle of the beach, mixing with seaweeds, fermenting and putrifying, and rendering the place almost uninhabitable. That town had been drained under the management of Mr. Rawlinson, and he (Mr. Hawes) could state that during the four or five years the drainage had been in existence the value of property there had very materially increased, far beyond the amount which the inhabitants had to pay in the shape of extra rates for the drainage, and the water supply which was connected with it. Knowing so well as he did the effects which had resulted from these improvements, he could say that there was not only an increase of health even in the worst parts of the town, but an increase in the prosperity of the inhabitants arising from the larger number of visitors who went there. Having regard to drainage as a means of improving the health of the great masses of the people, and improving also the value of property, the next question was to find the means for utilising the sewage. He did not undervalue the importance of ventilating this subject, as it would contribute to the store of information; but when he heard gentlemen talk about the necessity of going back to cesspools, he was surprised that any engineer of the present day, whatever might be the difficulties to be overcome, should for a moment think of reverting to the oldest, worst, and most abominable system ever resorted to. He should have expected to have heard from one in his position some such sentiment as this:—"Whatever may be the difficulties, they must be overcome, let the cost be what it may."

Mr. SMITH wished to ask Mr. Rawlinson whether he had considered the effects that would be produced upon the Thames under the system of arterial drainage which was now being carried out in the metropolis.

Mr. RAWLINSON said he held in his hand the report of Messrs. Bidder, Hawksley, and Bazalgette, but he had purposely avoided touching upon the question of the main sewerage of London. He had confined his paper entirely to illustrations of his own practice, and he had given the details of his own experience only, and therefore he must decline entering into the question as it affected London.

Mr. SMITH went on to remark that the sewerage of large towns had been a subject of study with him for the last eight or nine years, and he had been connected with extensive drainage operations in the city of Dublin in connection with the utilisation of the sewage for agricultural purposes. A great deal had been said as to the inefficacy of sewage as applied to agriculture. His own opinion was that in many cases this arose from the want of effective drainage, but if there were perfect drainage and filtration through the soil, he felt convinced that benefit must arise from the distribution of the sewage upon the land. With regard to the sewage of London, he was convinced that the plan now being carried out would be ineffectual to promote the end in view. He did not care how far down the river they carried the sewage, the tidal influence would bring it back again. There were two mechanical forces acting in opposition to each other, and wherever these were balanced the sewage would be precipitated, causing those accumulations which, under the action of the sun, were so detrimental to all large cities. He agreed with Mr. Haywood, that the time would soon come when, if the present system of sewerage was carried on to the extent it had been of late years, some legislative enactment must be introduced with regard to the distribution of the sewage over the surface of the earth as a fertiliser of the soil.

The Chairman said the time having arrived for bringing the meeting to a close, he would only say a few words. In the first place he must compliment Mr. Rawlinson upon the very able paper he had given them, which if placed in the hands of people in various parts of the country would give them information of great value. As far as he was concerned he would express generally his sense of the extreme value of perfect drainage and ventilation in all towns and cities; but he looked at the question rather in its agricultural bearings; while on the one hand they took care of the health of the people, they must on the other hand provide for their being cheaply and well fed, and he must say he hoped the time would come, as he had no doubt it would—when these valuable matters would be employed to a large extent in fertilising the land, which was exhausted by the products taken from it. He did not think people were generally aware how much land was annually exhausted for the purpose of providing food for the metropolis alone—the people and animals kept within it. He would state, as the result of a calculation carefully made, and which he believed came very nearly to the actual fact, that it required the produce of upwards of six millions of acres to feed the population of London and the animals employed in it. Taking that to be the fact, let them imagine where all that food was to go to after it had been consumed. Were they to think of putting it on 10,000 or 20,000 acres of land? Were they to rob the great extent of land required for the support of London alone of its natural fertiliser, and concentrate an enormous nuisance over a limited area? It was contrary to all reason; and he was sure the time would come when they must seriously entertain the question of spreading that valuable matter over a very large surface of the country to compensate the soil for the large annual demands that were made upon it. He had great faith in the agricultural intelligence and enterprise of the country; and though this was considered an impossible and unprofitable operation now, it would not be so fifty years hence. He had no doubt there would be great changes in that time; but to suppose they were to put on 6,000 tons an acre to create an enormous nuisance, as a general rule, was contrary to common sense. They had the authority of some of the most eminent chemists of the day, that the value of London sewage was 2d. per ton, taking it as compared with guano, and if it were applied within 40 or 50 miles of London, this could be done for a penny per ton. This country ought, with the means at its command, to be one of the richest agricultural countries, for its size, in the world. Last year they paid no less than £75,000,000 sterling for articles consumed by the population and animals in this country. That was an enormous sum, and the farmers of this country would know how to appreciate the value of that amount, if thrown back upon the land in the shape of fertilising agents; and the wasting of it must be regarded as a great national loss. He begged to move a vote of thanks to Mr. Rawlinson for his valuable paper.

The vote of thanks having been passed,

The Secretary announced that on Wednesday evening next, the 26th inst., a paper by Mr. Henry Ashworth, "On the Commerce of our Colonies and their Cost," would be read. On this evening the Right Hon. C. B. Adderley, M.P., will preside.

Home Correspondence.

THE MAURITIUS.

Sir,—I was not present on the evening of Wednesday, the 12th inst., when Mr. Morris read his paper on "Mauritius," or I should have demurred at the time to the correctness of the opinion which he expressed, that the present scale of duties on sugar constitutes a monopoly in favour of the English refiner, and as such a protectionist tariff.

As a sugar refiner, I ask the favour of the insertion of a few observations.

Monopoly must be a term quite inapplicable to a system which allows competition; and it will, I think, be evident, to those who consider the matter in all its bearings, that no protection is given to the home refiners, who, it should be stated, buy their sugars duty paid; and, in addition to the inferior sugars which they use, purchase largely of the descriptions which pay the higher rates of duty.

In the process of refining, the first step is to remove the impurities which exist in nearly all sugars as imported; afterwards, the crystallizable sugar is separated from that which is uncrystallizable, or molasses.

The existing scale of duties is calculated upon the theory that the lower qualities contain a larger proportion of molasses in combination with the sugar, and they are, therefore, admitted at a duty of 12s. 8d. per cwt.

Molasses being admitted at a duty of 5s. per cwt., the planters can, if they think it worth while, separate more of the molasses, or the whole of it; and the sugar will then have to pay, on arrival here, 13s. 10d., 16s., or 18s. 4d., per cwt.

If the assimilation of duties to one uniform rate be ever enacted, justice will require that the home refiners be either permitted to refine in bond—a course objectionable on revenue considerations, both to the Government and the trade—or that they be allowed, on exporting the molasses which they extract from the sugar, a drawback of the same rate of duty which may have been previously paid upon it, viz., that levied upon sugar; also on the molasses sold for home consumption, a difference between the duty on molasses and that of sugar.

Inconsistency in the decisions of Customs officers may be prevented by appointing to the post of assessors those only who have acquired a thorough knowledge of the various qualities of sugar, and retaining them in that position by an adequate remuneration, instead of making frequent changes. I am, &c.,

THOMAS HICKS.

11, Little Alie-street, E., 18th March, 1862.

BUILDINGS FOR INSTITUTIONS.

Sir,—There are many questions respecting the successful working of Educational Institutions for the people which have yet to be solved, and of these, perhaps, one of the most important is that which concerns the buildings where the operations of these Societies should be carried on.

Anyone having extensive acquaintance with the various aspects of Mechanics' and kindred Institutes, will not fail to notice the absence of general principles on which the buildings are arranged, the result being that in many cases a large outlay has only produced an inconvenient set of rooms, which might have been put up at half the cost, and have been far more useful, if planned with care. This large expenditure for building purposes often saddles a society with a heavy mortgage, which cripples the working of the institution, the screw being generally applied the more tightly to those very parts where the greatest amount of good should be effected.

It is true the Yorkshire and other Unions of Institutions have published plans of buildings which would, no doubt, be very suitable in many cases, but I do not recollect to have seen any general plan enunciated, by which the number of rooms, their size, &c., should be regulated, according to the population to be accommodated in any place.

During the summer we are promised a great gathering of the members, managers, and friends of all the principal Institutes in the country; and it might perhaps be possible for the Society of Arts, which has already done so much to raise the character of our educational institutions, to arrange a sort of conference on that occasion, with the special view of deducing certain broad principles on which substantial, commodious, yet economical buildings may be erected.

Two classes of buildings would, it appears, have to be considered,—those for rural districts, with a scattered population and but few houses in any particular spot, and those for towns having concentrated resources. The first would probably be resolved into a small reading room and library, fitted up at some roomy cottage, in the most central part of a parish, with little branch establishments in the remote parts, where the books from the library might circulate in parcels among those willing to read them. The village schoolroom would be the lecture-hall. In the second case, however, the conditions are so various that some difficulty would be experienced in arriving at anything like a universally applicable standard. Perhaps the calculations could be made from a unit of say 3,000 inhabitants. Once deduce the exact accommodation which an Institute for the population ought to require, and then calculations could easily be made for any larger place, according to the principles laid down in the first process. Twice the population would need rooms one-half as large again, and so on.

I venture to think that very much good may result from the discussion of this subject, and, with your permission, I will endeavour to point out, in a future communication, some of those general principles to which I have called attention.

I am, &c.,
JOHN JONES,
Organising Agent to the South Staffordshire Educational Union.

Dudley, March 12, 1862.

MEETINGS FOR THE ENSUING WEEK.

Mon......R. Geographical, 8½. 1. Dr. A. Barton, "On the Exploring Expedition to the Western Borders of China, and the Upper Waters of the Yang-tse-kiang." 2. Lieut. Oliver, R.A., "Notes on the Country to the West of Canton."
Actuaries, 7.
Medical, 8½. Dr. Anstie, "On the Treatment of Epilepsy."
Tues. ...Medical and Chirurgical, 8½.
Civil Engineers, 8. Mr. James Abernethy, "Description of Works at the Ports of Swansea, Silloth and Blyth." Part II.
Zoological, 9.
Educational Museum, South Kensington, 8. Mr. E. A. Freeman, M.A., "On the Difference between Minster and Parish Churches."
Royal Inst., 3. Mr. John Marshall, "On the Physiology of the Senses."
Wed. ...Society of Arts, 8. Mr. Henry Ashworth, "On the Commerce of our Colonies and their Cost."
Royal Soc. of Literature, 4½.
Archæological, 8½.
Thurs...Royal, 8½.
Antiquaries, 8½.
Philological, 8.
Philosophical Club, 6.
Royal Inst., 3. Professor Tyndall, "On Heat."
Fri.......Royal Inst., 8. Admiral Fitzroy, "An Explanation of the Meteorological Electric Telegraphy, and its basis now under trial at the Board of Trade."
Royal United Service Inst., 3. Dr. Parkes, F.R.S., "The causes of Sickness amongst British Soldiers during Campaigns, and the best means of preventing this sickness."
Sat.......Royal Inst., 3. Professor H. E. Roscoe, "On Spectrum Analysis."

To Correspondents.

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Erratum.—In the last number of the *Journal*, page 273, col. 1, line 43, for "years" read "centuries."

PARLIAMENTARY REPORTS.

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SESSIONAL PRINTED PAPERS.

Par
Numb.
30. Railway and Canal Bills (1. Abbey Holme, Leegate, and Bolton Railway; 2. Aberystwith and Welch Coast Railway. 3. Abingdon Railway; 4. Andover and Great Western; Andover and Redbridge; Andover, Redbridge, and Southampton Railways; 5. Banstead and Epsom Downs; 6. Barnsley Coal Railway Extension; Berwickshire Railway; 7. Bishops Waltham, Botley, and Bursledon Railway (No. 1); 8. Bradford, Wakefield, and Leeds (Deviation), Bradford, Wakefield, and Leeds (Further Provisions) Railway; 9. Bridge of Weir Railway; 10. Bristol and Clifton, Bristol and South Wales Union Railways; Bristol Port Railway and Pier; 11. Briton Ferry Dock and Railway; Burton upon Trent Railway; 12. Caledonian Railway (Deviations, &c.); Caledonian Railway (Leith Branches); 13. Cannock Chase Railway Extension; 14. Carlisle and Silloth Bay Railway and Dock; 15. Cleveland Railway; 16. Cromford and High Peak Railway)—Board of Trade Reports.

Delivered on 27th February, 1862.

14. Works and Public Buildings—Abstract Accounts.
30. Railway and Canal Bills (17. Dartmouth and Torbay Railway, Daventry Railway; 18. Deeside Railway; 19. Denbigh, Ruthin, and Corwen Railway, Dovey Reclamation; 20. Dundee and Perth and Aberdeen Railway Junction, and Dundee and Newtyle Railway; 21. Eastern Counties Railway (Colchester Branch); 22. Eastern Union Railway; 23. East Grinstead, Groombridge, and Tunbridge Wells Railway; 24. Eden Valley Railway; 25. Edgware, Highgate, and London Railway; 26. Faringdon Railway; 27. Fosterly and Stanhope Railway; 28. Furness and Coniston Railway Companies, Furness Railway; 29. Garston and Liverpool Railway, Great Northern Railway (Nos. 1 and 2); 30. Great Southern, and Western, and Limerick, and Castleconnel Railways, &c.; 31. Great Western, and Andover, and Redbridge Railway Companies, Great Western Railway (Additional Powers)—Board of Trade Reports.
19. Bills—County Courts Procedure.
20. ,, Births and Deaths Registration (Ireland).
21. ,, Bleachfields (Women and Children Employment).
24. ,, Prosecutions Expenses.
North America—Papers (No. 8) relating to the Blocade of the Ports of the Confederate States.

Delivered on 28th February, 1862.

11. Metropolitan Board of Works—Report.
52. Tenure and Improvement of Land (Ireland)—Returns
60. Russian Dutch Loan—Account.
62. London Bridge—Return.
65. Sardinian Loan—Account.
66. Greek Loan—Account.
68. Navy ("The Warrior")—Return.
61. Local Acts (1. Rogerstown Embankment and Reclamation)—Admiralty Report.
30. Railway and Canal Bills; (32. Great Western, Hereford, Ross and Gloucester, and Ely Valley Railway; 33. Hereford, Hay, and Brecon Railway; 34. Inverness and Aberdeen Junction, and Inverness and Ross-shire Railway; 35. Keighley and Worth Valley Railway; 36. Lancashire and Yorkshire Railway (Additional Powers), Lancashire and Yorkshire Railway (Doncaster, Goole, and Hull Junction Lines); 37. Leadburn, Linton, and Dolphinton Railway; 38. Leeds, Bradford, and Halifax Junction Railway; 39. London and Blackwall Railway; 40. London and North Western Railway (Addition3l Powers); 41. London and South Western Railway (Additional Powers); 42. London, Brighton, and South Coast Railway (Enlargement of Stations, &c.); 43. London, Chatham, and Dover Railway and Mid Kent Railway (Bromley to Saint Mary's Cray), London, Chatham, and Dover Railway (Extensions to Walmer and Deal), (Junction to Battersea, &c.); 44. Londonderry and Coleraine Railway, Londonderry and Enniskillen Railway; 45. London Railway Depot and Storehouses, London, Tilbury, and Southend Railway; 46. Maryport and Carlisle Railway; 47. Metropolitan and Thames Valley Railway, Metropolitan Railway; 48. Mid Kent Railway; 49. Mid Kent and Addiscombe Railway; 50. Midland Railway (Rowsley and Buxton Extension); 51. Mid Wales Railway (Deviations, &c.); 52. Much Wenlock and Severn Junction Railway; 53. Newry and Armagh Railway; 54. Newton and Machynlleth Railway; 55. Oldham, Ashton-under-Lyne, and Guide Bridge Junction Railway)—Board of Trade Reports.

Delivered on 1st and 3rd March, 1862.

23. Factories—Return.
69. Railway and Canal Bills—Second Report from Committee.
64. Court of Chancery (Ireland—Return.
70. Committee of Selection—Third Report.
22. Bills—Merchandise Marks.
23. ,, Register of Voters.
25. ,, Officers' Commissions.
26. ,, Copyright (Works of Art).
27. ,, Exchequer Bills (amended).

30. Railway and Canal Bills (56. Radstock and Kensham Railway; 57. Redditch Railway (Capital, &c.); 58. Rickmansworth, Amersham, and Chesham Railway; 59. Shrewsbury and Hereford Railway, Shrewsbury and Welchpool Railway; 60. Somerset Central, and Dorset Central Railway; 61. South Eastern Railway (Tunbridge and Dartford Lines, &c.); 62. South Yorkshire Railway and River Dun Company (Transfer, &c.); 63. South Yorkshire Railway (Hull Extension) and Sheffield and Thorne; 64. Tewkesbury and Malvern Railway; 65. Trent, Ancholme, and Grimsby Railway; 66. Ulster and Banbridge, Lisburn and Belfast Railway, Uxbridge and Rickmansworth Railway; 67. Vale of Clywd Railway; 68. Vale of Neath and Swansea, and Neath Railway; 69. Wycombe Railway)—Board of Trade Reports.
North America—Paper (No. 9), Copy of Despatch from Lord Lyons respecting the Obstruction of the Southern Harbours.

Delivered on 4th March, 1862.

63. National Debt (Savings Banks, &c.)—Account.
71. Queen Anne's Bounty—Account.
72. West India Islands, &c., Relief—Account.
73. Colonial Military Expenditure, and other Colonial Statistics—Returns.
20. Customs and Inland Revenue—Return.
28. Chancery Regulation.
30. Railway and Canal Bills (70. Brecon and Merthyr Tydfil Junction Railway; 71. Bristol and South Western Junction Railway; 72. Crystal Palace and South London Junction Railway; 73. Dare Valley Railway; 74. Drayton Junction Railway; 75. Dulais Valley Mineral Railway; 76. Eastern Counties Railway and other Companies Amalgamation; 77. Eastern Counties Railway (New Lines in Middlesex); 78. East Gloucestershire Railway; 79. Enniskillen and Bundoran Railway; 80. Great North of Scotland Railway)—Board of Trade Reports.

Session 1861.

491. Poor Rate, &c.—Return.

Dated 7th March, 1862.

75. Metropolitan Improvements;—Statement of Advances.
78. Sugar and Molasses;—Return.
79. Malt Bonded, etc.;—Return.
77. Foreign Wine;—Account.
84. Hyde Park;—Estimate for a Temporary Road.

PATENT LAW AMENDMENT ACT.

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APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March 14th*, 1862.]

Dated 10th January, 1862.

72. R. Johnson, Liverpool—An improved composition for coating the bottoms of iron ships to prevent their fouling, and which composition may be used as a protective coating for wood, iron, or other substances exposed to the action of sea-water.

Dated 17th January, 1862.

128. J. C. Dickey, Saratoga Springs, New York—An improved quartz crusher.

Dated 28th January, 1862.

227. W. Irlam, Newton Heath, near Manchester—Imp. in the construction of railway crossings and turntables.

Dated 29th January, 1862.

237. R. A. Brooman, 166, Fleet-street—Imp. in machinery for puddling metals. (A com.)

Dated 30th January, 1862.

251. A. C. B. Malois, Paris—Imp. in the manufacture of boot and shoe heels, and in machinery to be used therein.

Dated 11th February, 1862.

350. W. H. Weaver, Edington, Bridgenorth, and C. Gall, Bridgenorth—Imp. in machinery for cultivating, ploughing, harrowing, or scarifying the land.
351. T. Fyfe, 46, Leicester-square—Imp. in knapsacks and in apparatus for supporting them or other similar burdens upon the shoulders.
359. R. Johnson, Manchester—Imp. in welded wires used for telegraphic and other purposes.

Dated 13th February, 1862.

375. W. E. Newton, 66, Chancery-lane—Imp. in projectiles. (A com.)
377. J. Peters, Ulverston—Imp. in portable steam engines applicable to locomotive, stationary, and marine engines.
379. W. Williams, Bath—Imp. in pianofortes.
381. A. C. Ebbutt, 25, Blackman-street, Borough—Imp. in reclining, easy, and other chairs.
385. F. Falconer, Glasgow—Imp. in glasses for lamps.

Dated 15th February, 1862.

405. W. Avery, Birmingham—Imp. in machinery for the manufacture of screws, a part or parts of which improvements may also be used in the manufacture of pins, rivets, and nails.

Dated 17th February, 1862.

423. E. T. Hughes, 123, Chancery-lane—An improved method of, and apparatus for, collecting the gases given off from furnaces.
424. T. Birdsall and J. Birdsall, Leeds—Imp. in preparing hides or skins for tanning.

Dated 18th February, 1862.

492. C. D. Ségoffin, 4, South-street, Finsbury—An improved apparatus for the purpose of viewing photographs on cards.

Delivered 19th February, 1862.

437. H. B. Barlow, Manchester—Imp. in carding or otherwise preparing cotton and other fibrous materials and in machinery employed therein. (A com.)
438. J. Nasmyth, 31, Rue de l'Etoile, Brussels—Imp. in apparatus for obtaining a circular motive power.
442. J. Turner, 194, Upper Thames-street—Improved machinery for mixing, mincing, and pounding materials to be used in the preparation of food.
443. W. Hinton, Greville-street, Holborn—Imp. in barometers.
445. J. Paterson, Middle Temple—Imp. in means or apparatus for re-burning animal charcoal. (A com.)
447. G. T. Bousfield, Loughborough-park, Brixton—Improved modes of protecting iron boilers, tanks, and vats from wear arising from galvanic action.

Dated 20th February, 1862.

449. G. F. Lee, New Bridge-street—An imp. in tourniquets. (A com.)
453. J. Bleasdale and F. W. Borland, Accrington—Imp. in fluted rollers for preparing and spinning fibrous materials and in the mode of manufacturing the same.
455. J. Paterson, Middle Temple—Imp. in the use of animal charcoal. (A com.)
457. C. Wood, Bramford, Suffolk—Imp. in horse rakes.

Dated 21st February, 1862.

461. H. Ward, Castle Bromwich—An imp. or imps. in ladies saddles.
463. W. Hamer, Little Lever, near Bolton—Imp. in apparatus employed in the preparation of cotton and other fibrous materials.
464. E. S. Crease, 17, Gracechurch-street—Improved machinery for drilling, boring, or excavating rock or other earthy substances.
466. J. Krasuski, 29, Boulevart St. Martin, Paris—An improved apparatus for controlling fiery horses.

Dated 22nd February, 1862.

473. A. Bornemann, 29, Monmouth-street, Bath—Imp. in the mode of constructing fountains.
477. J. Townend, Bradford—Imp. in jacquard engines.
479. D. B. White, Newcastle-on-Tyne—Imp. in apparatuses for protecting liquids from the atmosphere while remaining in and during their discharge from the vessels containing the same.
481. G. J. Oram, 19, Wilmington-square—A revolving pendant for giving greater security to watches and lockets against theft.
483. W. B. Johnson, Manchester—Imp. in steam engines.

Dated 24th February, 1862.

485. W. Johnston, Glasgow—Imp. in gas and other lamps and stoves.
487. J. Cunningham and R. Cunningham, Paisley—An improved ornamental fabric, and imp. in weaving, and in jacquard apparatus.
488. J. C. Haddan, Bessborough-gardens, Pimlico—Imp. in small arms and in artillery, and in projectiles for artillery.
491. W. Clark, 53, Chancery-lane—Imp. in apparatus for feeding or supplying steam boilers with water. (A com.)
493. P. G. B. Westmacott, Newcastle-on-Tyne—Imp. in constructing and applying armour plating to ships, vessels, and forts.
495. L. Davis, Gloucester-gardens, Hyde-park, and F. M. Parkes, Marylebone-road—An imp. in the production or manufacture of gas for lighting and heating.
496. R. A. Brooman, 166, Fleet-street—Imp. in reaping and mowing machines. (A com.)
497. F. F. St. George Smith, Drogheda, Ireland—Imp. in machinery for grinding or reducing quartz, bones, grain, and other substances. (Partly a com.)

Dated 25th February, 1862.

503. J. Piddington, 52, Gracechurch-street—Improved condensing apparatus adapted for high pressure steam engines, especially locomotive engines. (A com.)
505. W. Clark, 53, Chancery-lane—Imp. in tobacco pipes. (A com.)
506. T. Watson and R. Dracup, Thornton, near Bradford—Imp. in means or apparatus for preparing and combing wool and other fibres.
511. W. M. Cranston, 58, King William-street—Imp. in machinery for reaping and mowing. (A com.)
512. C. Kingsford, Fenchurch-street—A new composition for the manufacture of bread.
513. P. J. Guyet, Paris—An improved coupling for uniting pipes between locomotives and tenders, applicable also to the coupling of other pipes.
514. H. W. Cook, Manchester—An improved mode of and apparatus for propelling carriages and vehicles by means of electricity.

Dated 26th February, 1862.

515. J. Boocock and T. Davenport, Bury—Imp. in machinery for preparing, spinning, and doubling cotton and other fibrous materials.
517. A. Stephen, jun., Glasgow—Imp. in the construction of ships or vessels.
523. T. King and R. Varvill, Liverpool—Imp. in apparatus for controlling the flow of fluids for flushing water-closets.

525. W. Miller, Upper Stamford-street, Blackfriars—Imp. in the manufacture of sugar.
527. W. Clark, 53, Chancery-lane—Imp. in the clasps or fastenings of bracelets, neck chains, and other articles of jewellery. (A com.)
529. W. P. Savage, Roxham, Downham, Norfolk—Imp. in fire arms.
531. J. Smith, sen., Coven, near Wolverhampton—Imp. in drying wheat and other grain.

Dated 27th February, 1862.

535. W. A. Gilbee, 4, South-street, Finsbury—Imp. in the construction of fire grates for steam and other boilers. (A com.)
536. W. Smith, Salisbury-street, Adelphi—Imp. in the method of making cigaretts, and in the apparatus employed therein. (A com.)
537. J. Tangye, Birmingham—An imp. or imps. in hydraulic lifting jacks.
539. T. Bray, Dewsbury—Imp. in ornamenting wood, in imitation of inlaid work.
541. J. R. Foster, Winsley-street, Oxford-street—Imp. in the manufacture of bullion-fringe or cord.
543. J. Revell, Dukinfield, Cheshire—Imp. in oil cans.

Dated 28th February, 1862.

544. P. D. Azemar, Paris—An improved mechanical arrangement for the winding up and the setting of the hands of watches by means of the knob of the pendant.
545. W. H. Muntz, Millbrook-lodge, Hants.—Imp. in paddle wheels.
546. A. W. Makinson, Westminster, and W. F. Batho, Birmingham—Imp. in locomotive engines.
547. J. C. Ratcliff, Coventry—Imp. in the covers or bindings for books and blotting cases.
548. G. McKenzie, W. F. Murray, and J. Hamilton, Glasgow—Imp. in machinery or apparatus for the manufacture of bobbins or holders for textile materials.
549. J. Pollock, 27, Budge row—Imp. in apparatus for protecting trousers from mud.
550. J. L. Charcouchet, Lyons, France—Imp. in machinery for breaking stone.
552. J. Parker, 6, Lilford-road, Camberwell, Surrey—An improved mode of applying steam as a motive power for propelling vessels, and for other purposes.

Dated 1st March, 1862.

553. T. Cowburn, Little Peter-street, Manchester—Imp. in apparatus for raising and discharging boiling soap, and for dividing the same into bars when congealed.
554. T. Bradford, Manchester—Imp. in washing machines for cleansing domestic garments, fibrous materials, and for manufacturing purposes.
557. M. Dodds, Hamsterley, Durham—Imp. in machinery for moulding, forming, or shaping articles of iron or other malleable metals, and for shearing and cutting such metals.
558. P. H. Boyer, Paris—Imp. in the manufacture of boots and shoes.
560. M. Gabriel and A. Gabriel, 33, Ludgate-hill—Imp. in the bases of artificial teeth.
561. S. Hague, Nottingham—Imp. in machinery or apparatus for raising hammers and stamping with them hot or cold metals.
562. A. E. Ragon, 4, Bernard-street, Russell-square—Imp. in electric alarums for telegraphic purposes. (A com.)
563. A. Potts, Cappagh, Down, Ireland—Imp. in machinery or apparatus for scutching and refining flax, hemp, and other vegetable substances.
564. P. Robinson, Sun-court, Cornhill—Imp. in treating yeast and in the manufacture of ammoniacal salts and a substitute for animal charcoal.
565. S. G. Reynolds, Bristol—Certain imp. in power spading machines.
566. J. G. Jennings, Holland-street, Blackfriars—Imp. in the construction of chimneys or flues.
567. J. B. Kendall, Boston, U.S.—An improved horse shoe.
568. L. Martin, Tenison-street, York-road, Lambeth, and O. Penfold, Blackmoor-street, Drury-lane—An improved candle-lamp.
569. C. Boolds, South-terrace, Kennington-park—Imp. in fastenings for gloves.
570. J. W. Davis and F. Davis, Hull—Imp. in apparatus for supplying feed water to steam boilers.
571. H. Bowen, Cardiff—Imp. in gas meters.

Dated 3rd March, 1862.

574. T. Bell, Wishaw, Lanark—Imp. in apparatus for distilling shale and other bituminous materials.
575. A. Sheldon, Tipton, and J. Sheldon, West Bromwich, Staffordshire—An imp. or imps. in smelting furnaces.
576. J. Schofield, Huddersfield—Imp. in looms for weaving.
577. A. Tevendale, Liverpool—Imp. in the apparatus used in connection with cooking stoves and domestic fire-places for the manufacture and supply of gas.
579. A. Bedborough, Southampton—Imp. in pillar letter boxes and letter bags.
580. J. B. A. Quiquandon, Paris—Imp. in Jaquard machines, and in the pattern cards to be employed therein.
581. G. Bischof, jun., Swansea—Imp. in treating ores and solutions containing copper and iron or either of them to obtain products therefrom.
582. W. Conisbee, Herberts-building, Waterloo-road, Southwark—Imp. in colour printing machines for letter-press or block printing.
583. H. Bunning, Field-house, New-cross, Deptford—Imp. in the manufacture of lubricating grease or compounds.
584. F. B. Houghton, 6, Clarendon-terrace, Kensington—Imp. in the manufacture of paper.

Dated 4th March, 1861.

587. B. Standen, Salford, near Manchester—Imp. in the preparation or manufacture of portable manure or fertilising compound, and in the collection or extraction therefrom of a certain liquid applicable to various purposes, and also in machinery or apparatus to be employed therein.
588. P. Schafer and F. Schafer, Golden-square—An imp. in travelling bags, portmanteaus, and other similar bags and cases.
589. J. T. Smith, Lee, Kent—An improved sight for fire arms, applicable also as an apparatus for measuring angles.
590. W. Tongue, Bradford—Imp. in machinery for breaking, rubbing, and scutching flax, hemp, or other vegetable fibrous materials, and in processes for treating silk waste.
591. A. J. Sedley, 210, Regent-street—Imp. in metallic bedsteads, sofa-bedsteads, and folding chairs or seats.
593. T. Greenwood, Leeds—Imp. in sewing machines.
594. G. F. Guy, Bury St. Edmonds—Imp. in electro-magnetic motive power engines.

Dated 5th March, 1862.

596. W. Tongue, Bradford—Imp. in machinery for preparing silk, flax, hemp, or other fibrous materials.
600. T. Bostock, Stone, Staffordshire—Imp. in the manufacture of boots and shoes.
602. F. N. Gisborne, 3, Adelaide-place, London-bridge—Imp. in the mode of indicating numerals or letters in railway tickets and other articles by peculiar devices cut therein, and in apparatus for effecting the same.

Dated 6th March, 1861.

604. J. Barker, Todmorden, Yorkshire—Imp. in, and means or apparatus for, casting drums, pullies, gear, and other wheels and bushes or keys for same.
606. T. Hack, Hammersmith, and A. Carter, Kensington—Imp. in screw cocks.

Patents Sealed.

[*From Gazette, March 14th*, 1862.]

March 14th.

2298. T. Morris, R. Weare and E. H. C. Monckton.
2300. S. Horsley and E. H. Jones.
2302. W. E. Gedge.
2312. F. M. Ransome and E. L. Ransome.
2315. F. Wrigley.
2316. F. Barnett.
2319. G. Davies.
2320. J. Statham and W. Statham.
2321. J. Lee and B. D. Taplin.
2323. G. White.
2328. E. Partington.
2331. E. Suckow and E. Habel.
2333. L. G. A. Condroy.
2341. W. T. Tongue and J. Greer.
2342. J. H. Wilson.
2380. A. J. Sedley.
2390. T. Bright and R. Mills.
2589. T. E. Merritt.
2740. E. A. Maling.
15. J. Howard E. T. Bousfield.

[*From Gazette, March 18th*, 1862.]

March 18th.

2339. E. Breffit.
2347. R. P. P. Dagron.
2351. J. Oliver, J. Grantham, W. Sinnock, and M. R. Leverson.
2353. J. C. Davidson.
2355. J. Burnand.
2359. F. W. Wymer.
2362. C. Board.
2363. H. Cockey & F. C. Cockey.
2365. W. Stableford.
2368. S. Desborough.
2369. J. H. Duley.
2373. H. Brinsmead.
2376. J. Price.
2377. J. Jacob.
2381. G. J. Gladstone.
2391. H. Purnell.
2416. J. Kimberley.
2422. J. A. Knight.
2440. F. Walton and R. Beard.
2486. J. Tweedale.
2548. S. R. Carrington.
2632. J. H. Johnson.
2802. T. C. Darby.
3201. T. Green, W. Green, and R. Mathers.
298. W. E. Newton.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, March 14th*, 1862.]

March 10th.

653. W. Clark.

March 11th.

631. J. Cunliffe, F. Piggott, and G. Mallinson.

March 12th.

641. R. A. Brooman.
761. G. Hazeltine.

[*From Gazette, March 18th*, 1862.]

March 13th.

706. W. C. Cambridge.

March 14th.

640. R. Waller.
649. W. Langton.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, March 14th*, 1862.]

March 11th.

555. J. M. Napier.

March 12th.

547. E. J. Mitchell.

[*From Gazette. March 18th*, 1862.]

March 13th.

571. J. Marland.

March 14th.

647. J. Willis.
741. P. R. Jackson.
801. S. Holt.

March 15th.

845. E. E. Allen.